MODEL AIRPLANE NEWS

OCTOBER 1953—25 CENTS

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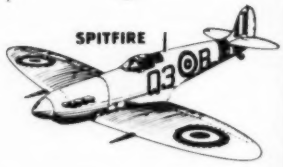
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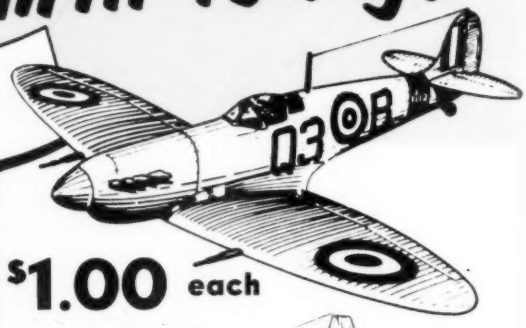
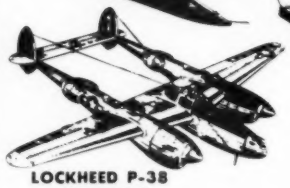


N. A. P-51 MUSTANG

CURTISS SB2C HELLDIVER

BELL P-39 AIRACOBRA

VOYAGER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Vought F7U Cutlass
Grumman F9F Panther
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Republic F-84 Thunderjet
Curtiss P-40 Warhawk

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Lockheed P-38 Lightning
N. A. B-45 Tornado
North American T-28 Trainer
Boeing B-47 Stratojet
Convair B-36 Bomber
Republic F-84 Thunderjet
Lockheed C-69 Constellation
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Boeing B-29 Superfortress
Russian MIG-15
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Transport
Northrop F-89 Scorpion
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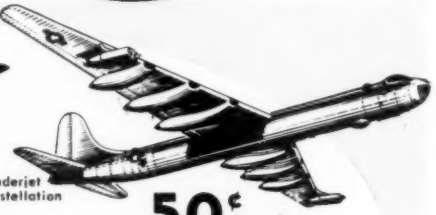

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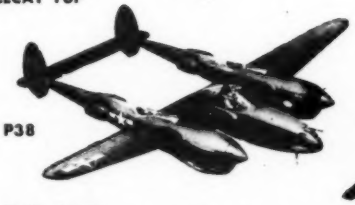

P-5 LOCKHEED LIGHTNING P38

P-12 SABRE JET F86D

KIT P-1 NORTH AMERICAN MUSTANG
KIT P-2 DOUGLAS A26
KIT P-3 REPUBLIC THUNDERBOLT
KIT P-4 GRUMMAN HELLCAT F6F
KIT P-5 LOCKHEED LIGHTNING P38
KIT P-6 CLIPPER, JR.
KIT P-7 PEPPER
KIT P-8 TAYLORCRAFT 54" WINGSPAN
KIT P-9 AERONCA 54" WINGSPAN
KIT P-10 PIPER CUB 40" WINGSPAN
KIT P-11 GULL
KIT P-12 SABRE JET F86D

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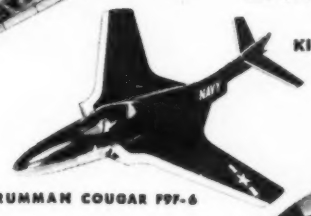

M8—GRUMMAN COUGAR F9F-6

M7—DOUGLAS SKY KNIGHT F3D-1

KIT M-1 TAYLORCRAFT
KIT M-2 PIPER CUB
KIT M-3 AERONCA
KIT M-4 BEECHCRAFT BONANZA
KIT M-5 BELLANCA CRUISAIR
KIT M-6 ERCOUPE
KIT M7—DOUGLAS SKYKNIGHT F3D-1
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KIT M9—NO. AMERICAN MUSTANG F51

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- Fuel-proof plastic cowling!
- All parts neatly cut out—ready to use!
- Decal emblem and numerals!
- All necessary finished metal parts Dethermalizer equipped!

the U-Control

LITTLE SCHMOE

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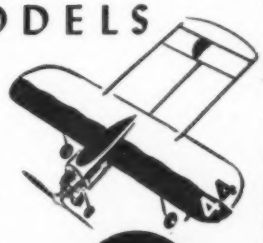

$1.50 KIT NO. T-17

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MODEL AIRPLANE NEWS

25th Year of Publication

OCTOBER 1953 Vol. XLIX—No. 4

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by William Winter

That American interest in FAI gas models will suffer growing pains is inevitable from the incompatibility of FAI rules and common sense. Those rules, as well as Wakefield rules, and any rules that unduly emphasize processing, would hopelessly bog down contests with a large entry list. This is not idle talk, for any free flight fan with more than five seasons under his belt shudders at the memory of pre-1948 meets when you stood in line until four o'clock, didn't get all your flights, or perhaps, did not fly at all. Nationwide pressure compelled abandonment of wing loading and cross section rules. When contests really become popular, rules must be the simplest. For such reasons it is impossible to operate exclusively under FAI rules (though one set of rules is ideal for international modeling) regardless of our eagerness to cooperate. So far, we have included in our own rules book the Wakefield and Nordic rules. We have maintained alongside these two types, associated, simpler machines for the less advanced builders. Though Wakefield may dominate rubber, and Nordic the glider competition, one may wonder whether our own free flight rules, so lengthily developed by trail and error, would ever be secondary to FAI power rules. Such a situation will tend to retard the growth of FAI gas flying in the U. S. Don't get us wrong. There will be plenty of activity but it will not be on the scale it should be. It is pretty tough to foul up a big contest with a lot of measuring and checking, especially when the models almost automatically fulfill the requirements. Would anyone wish to build a plane with lighter loadings than the rules specify? Or less cross sections? To do so with our flying conditions would indicate the designer had rocks in the head.

(*Continued on page 5*)

PLANE ON THE COVER

The Short SB-5, yet another of the many odd and wonderful experimental planes the British are flying about, roughly duplicates the function of the Bell X-5 in this country. Its most unique feature is its folding wing which may be angled back at 50, 60, and 69 degrees of sweep. Its tail plane may be mounted above or below the fuselage and is adjustable in incidence through 20 degrees. Construction is metal, although the leading and trailing edges are ply. The landing gear is fixed which temporarily keeps things simple. Powerplant is the Rolls Royce Derwent turbine.

NEXT MONTH'S COVER

The Fokker Triplane, or "Tripe," undoubtedly is the all time reader favorite and was chosen by popular demand. Jo Kotula, the cover artist, brings it back to life. Probably the most maneuverable airplane ever built, the Tripe could turn on a dime. Power was only a 110 hp Oberursel. But 150 machines built succeeded in destroying 320 allied fighters.

Now... announcing

NEW OK CUB

SERIES OF DIESEL ENGINES!

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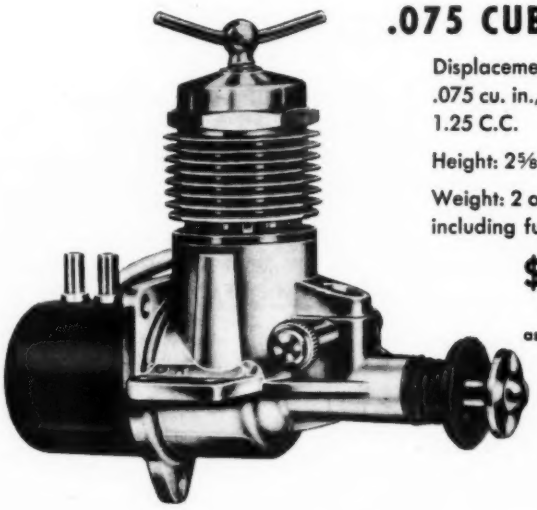

.075 CUB DIESEL

Displacement
.075 cu. in., or
1.25 C.C.

Height: 2⅝ in.

Weight: 2 oz.
including fuel tank

$7.50
as illustrated

SIMPLICITY ITSELF . . . NO IGNITION ACCESSORIES NECESSARY—NO BATTERIES—NO GLOW PLUG—NO IGNITION HARNESS—NO CONNECTING CLIPS ALL YOU NEED IS

"OK" CUB DIESEL FUEL

Specially developed for high-speed, high compression "OK" Cub Diesels, this quick-firing diesel fuel assures "on time" firing, complete combustion, no varnish or residue, and better all around performance.

SETTING NEW STANDARDS IN ENGINE PERFORMANCE

The age of the diesel is definitely here. Model enthusiasts everywhere are demanding them. Demanding diesel simplicity and lightness. But they're also demanding high power/weight ratio . . . easy starts . . . dependable flight performance . . . and reasonable cost. Factors that only high-precision, mass-production machinery, and skilled engineering can produce.

Herkimer "OK" Cub Diesels Supply The Demand for Finer Diesel Power-Plants

Herkimer's modern, high-precision, mass-output plant is ideally suited to supply today's demand for a finer diesel power-plant. Engineered, machined and inspected with the exacting thoroughness of modern automotive and aircraft production practice, Herkimer "OK" Cub Diesels out-climb, out-fly and out-perform any other diesel—imported or domestic—in the miniature engine field. The power/weight ratio is exceptionally high. They're easy to start. The adjustable-compression heads allow adjustment to local conditions and altitude. That means quicker firing, more complete combustion, more power at the top of the stroke, and cleaner scavenging. And the price is right for the popular pocketbook.

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OR WRITE DIRECT

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Conrad Conrod

FOR GOSH SAKES - LOOK AT THIS
WHAT IS IT CONNIE?
IT'S A 1934 MODEL AIRPLANE NEWS, WES HAD IT IN THE BACK ROOM
MODEL AIRPLANE NEWS
LOOKIT THESE ADS - THOSE WERE THE GOOD OLD DAYS - DIME KITS WITH 36" WINGSPAN - CEMENT IN A BOTTLE, AND REMEMBER THE SMELL OF THAT CEMENT? OH IT BRINGS BACK TENDER MEMORIES
IT DOES?
YEAH, (SIGH) THOSE WERE THE DAYS - REMEMBER THOSE 1/4 SCALE KITS THAT HAD RIBS AN 1/8 INCH APART? HAD EVERYTHING IN 'EM BUT THE PINS -
OH WELL (SOB) I SUPPOSE THOSE DAYS ARE GONE FOREVER-
DON'T GIVE ME THAT STUFF
NO SALE
YOU WERE THE ONE WHO USETA GRIPE ABOUT HAVING TO CUT OUT ALL THOSE RIBS AND NOT ENOUGH CEMENT - YOU NEVER HAD IT SO GOOD
YOU SHOULDA BEEN AROUND WHEN WE CUT UP FISH POLES FOR LONG - -ERONS, AND DISSOLVED TOOTHBRUSH HANDLES IN ACETONE FOR CEMENT!
NO SALE!
YEAH, THAT WAS ROUGH, BUT I REMEMBER A CURTISS GOSHAWK KIT I HAD, THAT HAD 108 RIBS TO CUT OUT - SAY WES, LEMME LOOK AT THAT KIT -
YES SIR! THAT GOSHAWK WAS A REAL KIT IT HADA ~~ FOR GOSH SAKES WES, DO YA HAVE TO CARVE THIS COWL?
YEP - I SPENT FOUR MONTHS ON THE FUSELAGE ALONE AND - GEE WHIZ THE DIE-CUTTING ON THESE RIBS ISN'T SO HOT, AN' DO YA GOTTA DRILL OUT YOUR OWN MOTOR MOUNTS?
- AND HOW COME THE WINDSHIELD ISN'T CUT OUT? AND THE — HEY WES - WHAT'S THIS STRAIGHT PIECE OF WIRE FOR?
THE LANDING GEAR, OLD TIMER - THE LANDING GEAR
RWG

MAN at Work

(*Continued from page 2*)

▶ MAN is, nevertheless, an ardent supporter of American participation in the International Power event as well as the Wakefield. At a time when only the Aeromodeller, in England, was championing the multi-event international contest, MAN was fighting the "Wakefield only" school of thought that kept us virtually ignorant of, and indifferent to, other world-wide events of at least equal importance. (And when are we going to compete in controlline?)

As this is being written, the American team is on the way to England. Whereas six team members used to fly our best Wakefields, now the eight man team is divided four and four, with free flight equally sharing the spotlight. It would seem that the pressure has been doubled for, although we always make a good showing in Wakefield, but without winning it since 1939, foreign eyes will be watching the vaunted American free flighters. Its our guess that the going will be rough; the other lads have a world of know-how in handling the FAI jobs.

* * *

▶ Which brings us to this October issue of MAN. The lead, appropriately, is an imposing analysis of prominent FAI jobs. Ron Warring, the author, is respected wherever models are flown for his dispatch in dealing with these ponderous subjects. His article rounds out MAN's groundwork in this category—previous articles including Woody Blanchard's FAIson, and Pete Chinn's Internationalist, the first such jobs published in detail in this country.

Radio hobbyists will be equally impressed by A. L. Morgan's intriguing article on transistors. Transistor articles have been rejected by MAN despite the temptation to be the first in print. When Morgan made the suggestion, he was told that MAN would publish such an article only when the reader could be given something to sink his teeth into. The miracle aspects of these little gismos make a good newspaper copy but leave the modeler up in the clouds. Think you'll agree that Morgan laid it on the line.

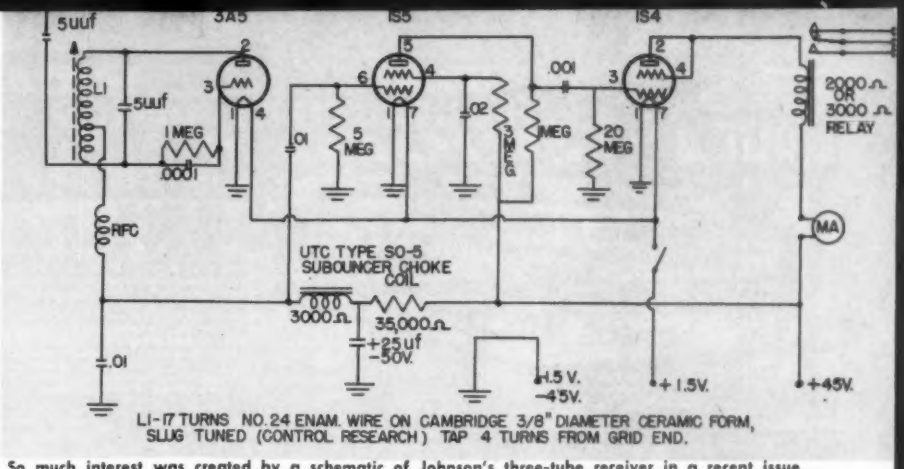
A word about MAN's policy on RC stuff would go well here. Receiver and transmitter construction features will not be published just for the sake of publishing radio material. Either there must be a need for a given item, or the item must point up progress, otherwise it will not be published. So far, the Miller hard tube receiver and the Lorenz two-tube (soft tubes) receiver have filled the bill. A crackerjack transmitter by Ed Lorenz will be featured in some future issue—lots of development behind these things! The radio ships themselves are thoroughly proved, functional designs. Scale is being held in abeyance until enough RC'ers have had experience to handle the more specialized planes.

* * *

▶ For several years, your editors have been squarely in the middle of an argument over the best size in U-control design for the average modeler. One group holds that the big engine ships are too expensive, require too much room, make too much noise, and should be banished to Siberia. The older, more experienced fliers throw a fit every time a Half-A engined design makes its appearance. Harder to fly, turns over on rough ground and grass, and so on. Just to prove that everything does not have to be either black or white, Harry Williamson, whose creations for MAN have wide respect, put together Spooky. Spooky is neither big nor little. It stunts to beat the band on its .09 power.

C. O. Wright, ex-AMA prexy, and modeler of thirty years standing, tosses a

(*Continued on page 8*)



So much interest was created by a schematic of Johnson's three-tube receiver in a recent issue, that Paul supplied this schematic for a 27.255 job now flying. It includes additional information.

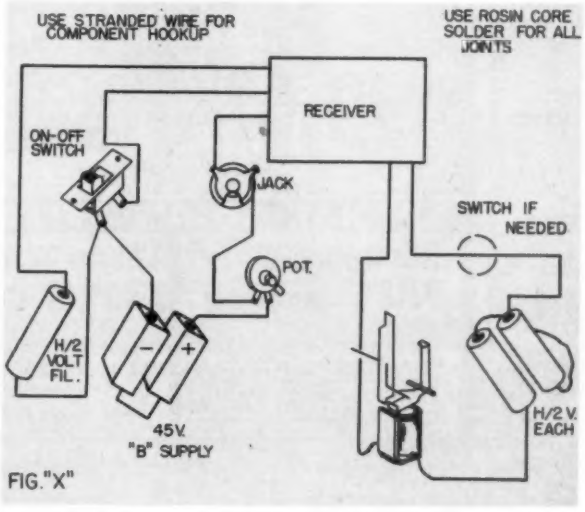


FIG. "X"

for the RC FAN

by ED LORENZ

Beginning this month, the author discusses the things that contribute to failures and shows the precautions to be taken against fly-aways.

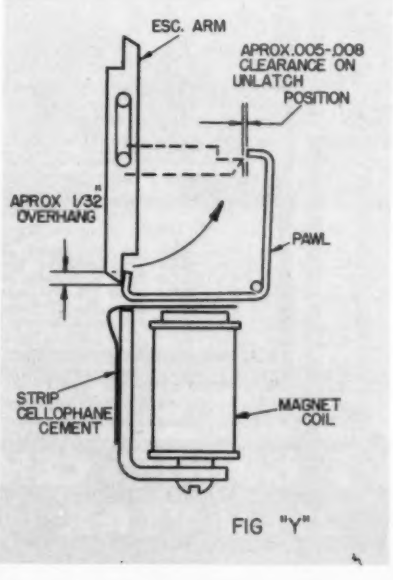


FIG "Y"

▶ Sooner or later every radio modeler has a flight failure. Most often the cause is obvious. Batteries may have been rundown and unchecked, or the escapement not wound, or the switch not turned on, or an idle current not checked. Other causes are more difficult to track down. It is surprising how many things can go wrong if the flier mismanages his equipment.

Any discussion of causes of failures and the means of avoiding them necessarily must be a long one. As part of this column for the next several issues this challenging topic will be studied from A to Z.

For reference Fig. "X" shows the typical circuit hookup of a radio receiver installation and covers the wiring, batteries, escapement, switches and components such as rheostats and meter jacks.

First of all, we must face the fact that everytime a crash or misfunctioning occurs,

(*Continued on page 40*)

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Cessna 36" A-B 6.95
Chief 53" B-C 6.95
Combat Sky Ace 36" A-B 2.95
Corsair 17" A-AA 2.95
Curtis P40F 20" AA 3.95
Curtiss Hawk P6E 17½" AA 2.95
Douglas Navy Skyraider (Plastic) 15½" AA 5.00
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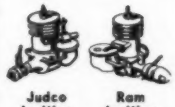

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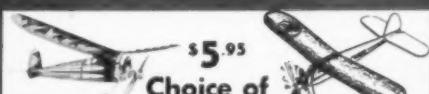

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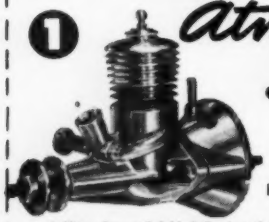

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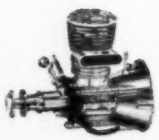

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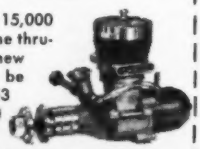

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MAN at Work

(*Continued from page 5*)

bombshell with his "Keep That Gassie Spinproof." The loud crashes you hear are theories going out the window. Lots of other controversial and "think" stuff, too.

• • •

▶ If New York isn't helicopter conscious after Jim Walker's last trip east, we might as well give up. Jim sailed down Fifth Avenue in a Buick Skylark, radio telephone in hand, calling up his modeling friends. Cal Smith, down in Red Bank, said he could hear the auto horns. Jim summoned MAN at Work to a flying session on busy 45th Street. A department store buyer answered another call and soon the demonstration model of the Ceiling Walker was reaching the tops of tall buildings. That night the Shriners held one of their terrific parades up Broadway. So there was Jim on Times Square sending helicopters up into the bright lights. A searchlight operator was betting Jim five bucks a flight he could tail the things with his beam. At 49th Street, one got caught in a thermal, would wind down and descend, then wind up and rise. This really got the crowd.

• • •

▶ Then Bill Effinger checked in with a real brainstorm, a seaplane contest on Long Island Sound, off Bayville, on September 26. The official title is the Long Island Sound Hydro Championships. If this sort of thing goes on, we'll have the Goose Bay Flying Boat Champ, Gulf of Lower California ROW Champ, and so on. Seriously, with flying sites being wrecked by the Earth Movers, boots and row boats will be part and parcel of every tool kit hereabouts. Thinking of making RC boats—since we live on a bay—but then you need an outboard to chase the consarned things. And it gets windy, rough, cold, in the winter. Anyhow, the Screamin' Demons will put this one on. Half-A payload, AB; Half-A boat, AB boat; and RC boat. If the spot ever floats away, it'll be tough on the RC boys! Pan American, America's Hobby Center, and Mercury Outboard Motors share the sponsorship with Berkeley. Retrieving will be done with high speed motor boats! You can bring your own outboard but you must furnish your own life jacket. Man overboard!

• • •

▶ From Bill Dean, this dope on the British Nationals:

"This Coronation Year, the British Nationals were held at Waterbeach Airfield on the outskirts of the University Town of Cambridge—some 50 miles north of London. The seventh such meeting, the two-day '53 Nats will be remembered for the perfect weather conditions and the top-notch contest flying. Forty beep-box fans turned up for the RC event—which was won by Sid Sutherland's speedy Amco 3.5 Diesel powered original cabin (home-built hard tube RC). The trend in RC design was toward smaller and higher powered models, which flew at speeds ranging up to 40 mph.

"This year, a PAA-load event (with gold watch prizes donated by Pan American) was included in the Nats—with Ken Flynn chalking up a maximum (three flights of three minutes each) for first place. His design was original, but influenced by the types at present popular in the U.S.A. The powerplant was an Elfin 2.49 Diesel and wing area about 520 sq. in. Competition was keen in all free flight events—which embraced open power, open rubber and open glider. With flights of over three minutes being recorded as maximums for these events, fly-offs were

(*Continued on page 39*)

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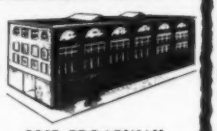

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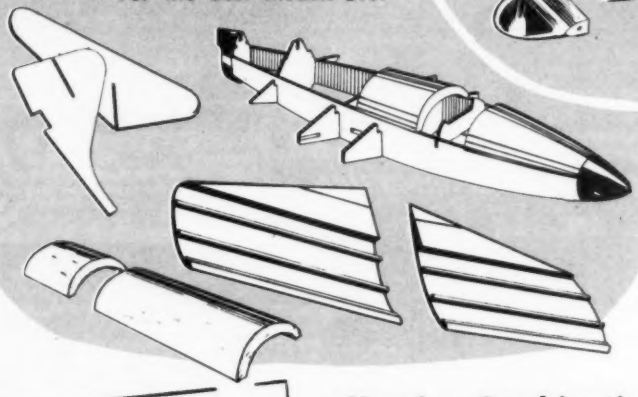

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Lippens, well known Belgian modeler, about to release his free flight during last year's International Power Event. Odd polyhedral featured.

Those FAI GASSIES... By RON WARRING

For the first time an American team has competed in the International Power Championships. With interest on the rise, this data proves valuable.

Silvio and Wheeler's 1952 FAI finals victor. British, who won, go in for pylons, and high climb, as does the U.S. The Continent favors the glide.

THE FAI Gas specification is so wide as to permit the use of almost any model up to about 750 sq. in. wing area (provided it conforms to the wing and power loading requirements), powered by any size of engine up to 2.5 c.c. (.15 cu. in.). You don't *have* to use a .15 engine. The first world championship gas event (held in 1951, in Switzerland), was won by a 2.5 c.c. engine. The 1952 event was won by a British model with a 1.5 c.c. engine. Most people prefer the larger size of model and engine, however, on the theory that large size increases efficiency. Nobody has yet made any serious attempt to use a motor smaller than 1.5 c.c. (about .099 equivalent), such as an American Half-A or British .5 c.c.

The chief requirements are a minimum model weight of 116 oz. per cu. in. and a minimum loading of 2.73 oz. per 100 sq. in. *total* area (combined wing and stabilizer area). There is also a minimum cross section rule (total area/80), but unless you deliberately aim for "flying pencil" lines, any normal configuration more than satisfies this particular requirement.

The power and wing loading rules lead to a "natural" model size for each paticular engine size. Multiply the engine displacement by 116 and you arrive at the total weight required (in ounces). Apply the loading formula to this weight and you get the *total* area required. Built to that size and right down to the minimum weight you have a model conforming exactly to the specification. But you can make it

heavier for the same size, when your wing loading is that much higher. This is bad design practice, for you do not gain anything. Adequate structures can be built within the minimum weight required.

On the other hand, you can make the model *smaller* for the same weight, which again increases the wing loading, but this time you gain out in having a faster-climbing model. If this is not overdone, you can gain that extra altitude so helpful in thermal hunting. Glide performance will suffer a bit by the heavier loading. Take care not to make the model so small that it becomes too tricky to trim out properly, or the wing loading becomes excessively high and ruins the glide performance.

If you make the model *larger*, you must increase the total weight to conform to the required minimum loading figure. You have a bigger model for greater aerodynamic efficiency and improved glide, but one with extra wing drag and extra weight and climb will suffer accordingly. However, the slightly larger model is that much easier to control and trim. Since trimming is less critical, you may even be able to get a better climb that a smaller "hot" job by arranging a more efficient thrust line setting.

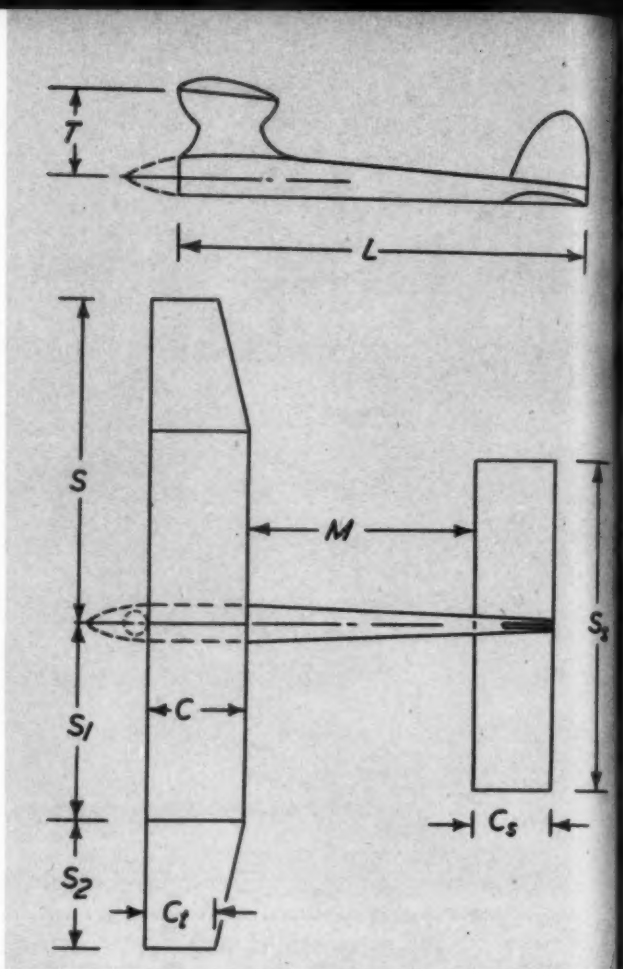
These limits in size are a little difficult to fix. They depend on the design layout, for one thing. High-wing or shoulder-wing designs usually tend to the larger size to improve their controllability. Some modelers have a particular flair for trimming out a machine for just about as perfect a glide as you could get, and may well decide to adopt a large model to take advantage of this. The other fellow may have a flair for trimming out a model for perfect climb performance and never achieve the best of possible glides. The two seldom go together. The latter flier is happiest with a small model which may defy all the efforts of a less competent modeler to control at all.

Then again, there is engine power. For the same size of engine, and even for individual engines of the same make, power delivered may be quite different. Small manufacturing differences, different fuels, different operating speeds, as governed by the propeller, may overpower one and underpower another of an identical design.

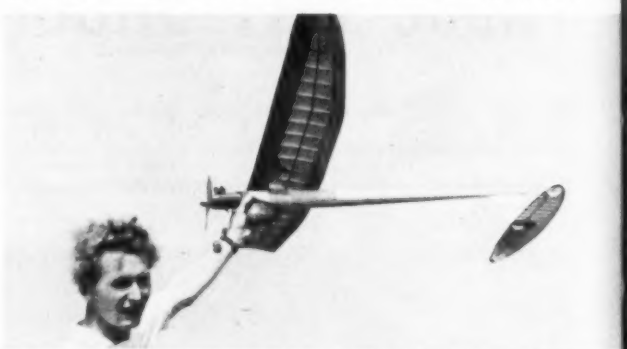
Several years ago the writer had a Banshee powered by a spark-ignition Ohlsson 23, which won several major events in Britain. Engine speed was limited by a stop beyond which the ignition could not be advanced—simply because the model became uncontrollable with more than that engine speed. Flown at Dublin in the Irish Nationals, that model came to an untimely end when the points were cleaned after an erratic run. A few extra rpm resulted in a 15 second flight pattern far more advanced than anything possible with controlline stunt.

Maximum and minimum size limits, therefore, are rather arbitrary. The European tendency is to use a *larger* model than that calculated right down to the specification for 1.5 c.c. (.099) engines and a *smaller* model with 2.5 c.c. (.15) engines. In other words, it is found that increasing the area of the smaller model (.099 size) does not detract from the climb and definitely improves the glide, as well as making the model easier to handle. To get a really hot climb with a 2.5 c.c. engine (.15 cu. in.), on the other hand, a model with reduced wing area is generally adopted.

This is no universal rule but, generally, it can be said that, using a 1.5 c.c. motor (.099), European designs conform to a range of sizes from 360 to 475 sq. in. total area. With an .099 glow motor we would say limit the upper size to 450 sq. in. total area. With 2.5 c.c. Diesels, sizes tend to range from 490 to a maximum of 700 sq. in. total area. Designing for .15 cu. in. glow motors, again cut these limits to, say, 450 to 600 sq. in. total area. Although the displacements of both the Diesel and glow motors may be similar, in these small sizes the Diesels tend to have the edge and hence the (*Continued on page* 51)

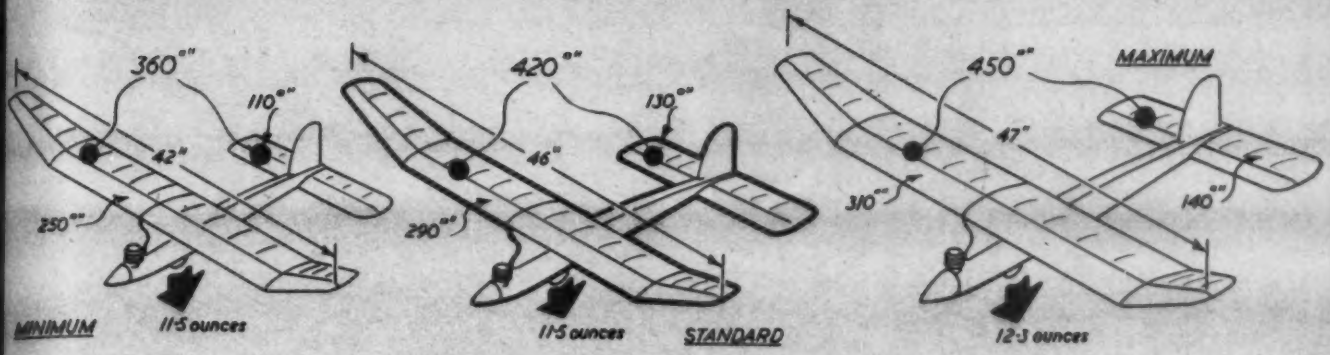


Basic layout, proportioned according to table, opposite page. FAI designs listed are essentially of same layout—other jobs representative of leading European designs of 1951-52. Actual outlines naturally vary.



Austrian models tend to be unorthodox, largely based on theoretical ideas but lacking practical features. All of them showed lack of rigidity.

Below—Jacques Morisset, leading French gas model flier, favors the pylon layout with strut braced wing. Dig the "foot hills" in background!



DESIGNER	COUNTRY	MODEL	S	S_1	S_2	C	C_T	WING AREA	ASPECT RATIO	DIHEDRAL	WING PLAN	WING POSN.	STAB S_2	STAB C_2	STAB AREA	STAB %WING	TOTAL AREA	WEIGHT (OZ.)	ENGINE	DISPLACEMENT CU.IN.	DISPLACEMENT CC.	LOADINGS TOTAL†	LOADINGS WING†	LOADINGS POWER	FUSELAGE L	FUSELAGE M	FUSELAGE T	REMARKS
FAI MIN. (.099 GLO OR 1.5 CC DIESEL)			21	12 1/2	8 1/2	6.25	4 1/4	250	7.1	POLY	P-TT	PYLON	21	5 1/4	110	44	360	11.5/10.8	GLO/DIESEL	.099	1.5	3.3/3.0	4.6/4.28	116	26	15	4 1/4	BASED ON DESIGN OUTLINE SHOWN IN DRAWING. NOMINAL 40% STAB. IN ALL CASES AREAS ADJUSTED BY ROUNDING OFF WING AND STAB. TIPS.
FAI STD. (1.5 CC)			22	13	9	6.6	4.4	270	7.2	"	"	"	22	5 1/2	124	46	394	10.6	DIESEL	–	1.5	2.7	3.9	116	27 1/2	16 1/2	4 3/8	
FAI STD. (.099 CU.IN.)			22 3/4	13 3/4	9	7	4 1/2	290	7.2	"	"	"	22.5	5.7	130	45	420	11.5	GLO	.099	–	2.7	4	115	28 1/2	16	4 1/2	
FAI MAX. (.099 GLO)			23 1/2	14	9 1/2	7	4 3/4	310	7.1	"	"	"	23 1/2	6	140	45	450	12.3	GLO	.099	–	2.7	4	124	29 1/2	16 1/2	4 3/8	
FAI MAX. (1.5 CC DIESEL)			24	14 1/2	9 1/2	7 1/4	4.8	327	7.0	"	"	"	24	6	147	45	475	13.0	DIESEL	–	1.5	2.7	4	131	30	17	4 3/4	
FAI MIN. (.15 GLO)			23 1/2	14	9 1/2	7	4 3/4	310	7.1	"	"	"	23 1/2	6	140	45	450	17.7	GLO	.15	–	3.9	5.7	118	29 1/2	16 1/2	4 3/4	
FAI MIN. (2.5 CC DIESEL)			25	15	10	7 1/4	5	340	7.35	"	"	"	25	6	150	44	490	17.7	DIESEL	–	2.5	3.6	5.2	118	31 1/2	17 1/2	5	
FAI STD. (.15CU.IN.) & MAX. (.15 GLO			23.4	17	11.4	8 1/2	5.7	450	7.15	"	"	"	30	6 1/2	200	45	650	17.7	GLO/DIESEL	.15	2.5	2.7	3.9	115	35 1/2	20	5 1/2	
FAI MAX. (2.5 CC DIESEL)			29	17 1/2	11 1/2	9 3/4	6	480	7.0	"	"	"	30	7 1/4	220	46	700	19.1	DIESEL	–	2.5	2.7	4	127	36 1/2	21	6	
J. GORHAM	G. B.	LIL' AUD	21 1/2	14	7 1/2	7	5	286	6.5	TIP	P-TT	"	22	5	110	38	396	10.6	ELFIN	.09	1.49	2.7	3.7	118	30 1/2	17	4	LEADING BRITISH DESIGN '50-'51
B. WHEELER	G. B.	ELIMINATOR	23 1/2	14 1/2	9	7	4 3/4	300	7.4	POLY	"	"	25	6	150	50	450	12.5	ELFIN	.09	1.48	2.8	4.2	130	30	16 1/2	4 1/2	'52 WORLD CHAMPIONSHIP
R. WYATT	G. B.	–	24	15	9	7 1/2	5 1/2	330	7.1	TIP	ST-TT	"	29 1/2	6	170	50	500	18	ELFIN	.15	2.49	3.6	5.5	120	40	24	6	BRITISH CHAMPION '51
J. GORHAM	G. B.	CONTENDER	23 1/2	14 1/2	9	8	6	366	8.2	"	P-TT	"	32	5 1/2	120	33	476	18	ELFIN	.15	2.49	3.8	5	120	38	19 1/2	8	TOP BRITISH 2.5 CC MODEL
SCHMID	SWISS	KOMET	39 1/2	–	–	8 1/2	–	608	10.3	POLY	P	SHLDR.	–	–	187	31	795	26	CASTOR	.15	2.46	3.3	4.3	173	–	–	–	2ND PLACE '52 WINNER '51
CASTIGLIONI	SWISS	–	29	–	–	7.2	–	414	8.1	"	P-TT	PYLON	–	–	130	34	544	19	SUPER TIGRE	.15	2.46	3.5	4.6	127	–	–	–	–
PROHASKA	YUGO	–	22 1/4	–	–	9.8	–	440	4.8	"	ST-TT	"	–	–	166	38	606	21	ELFIN	.15	2.49	3.5	4.9	140	–	–	–	'BANSHEE' LAYOUT
LANGE	GERM.	–	28 3/4	–	–	8 1/2	–	347	8.2	"	P-ET	"	–	–	103	30	450	19	WEBRA	.15	2.46	4.2	5.5	127	–	–	–	–
LIPPENS	BEL.	–	29 1/2	–	–	8.1	–	367	8.4	"	P	SHLDR.	–	–	145	40	492	28	E-D	.15	2.46	5.7	8.1	107	–	–	–	TWIN FINS

AREA AND DIMENSIONS IN INCH UNITS

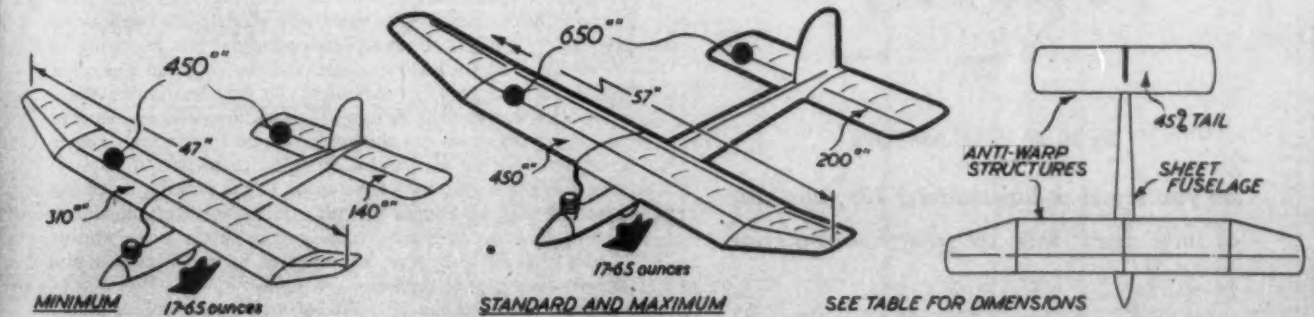
P = PARALLEL CHORD
ST = STRAIGHT TAPER

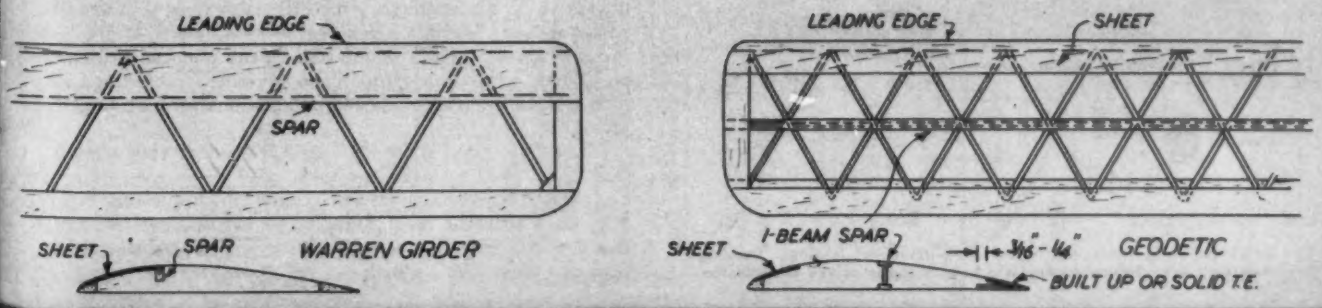
TT = TAPERED TIPS
ET = ELLIPTIC TIPS

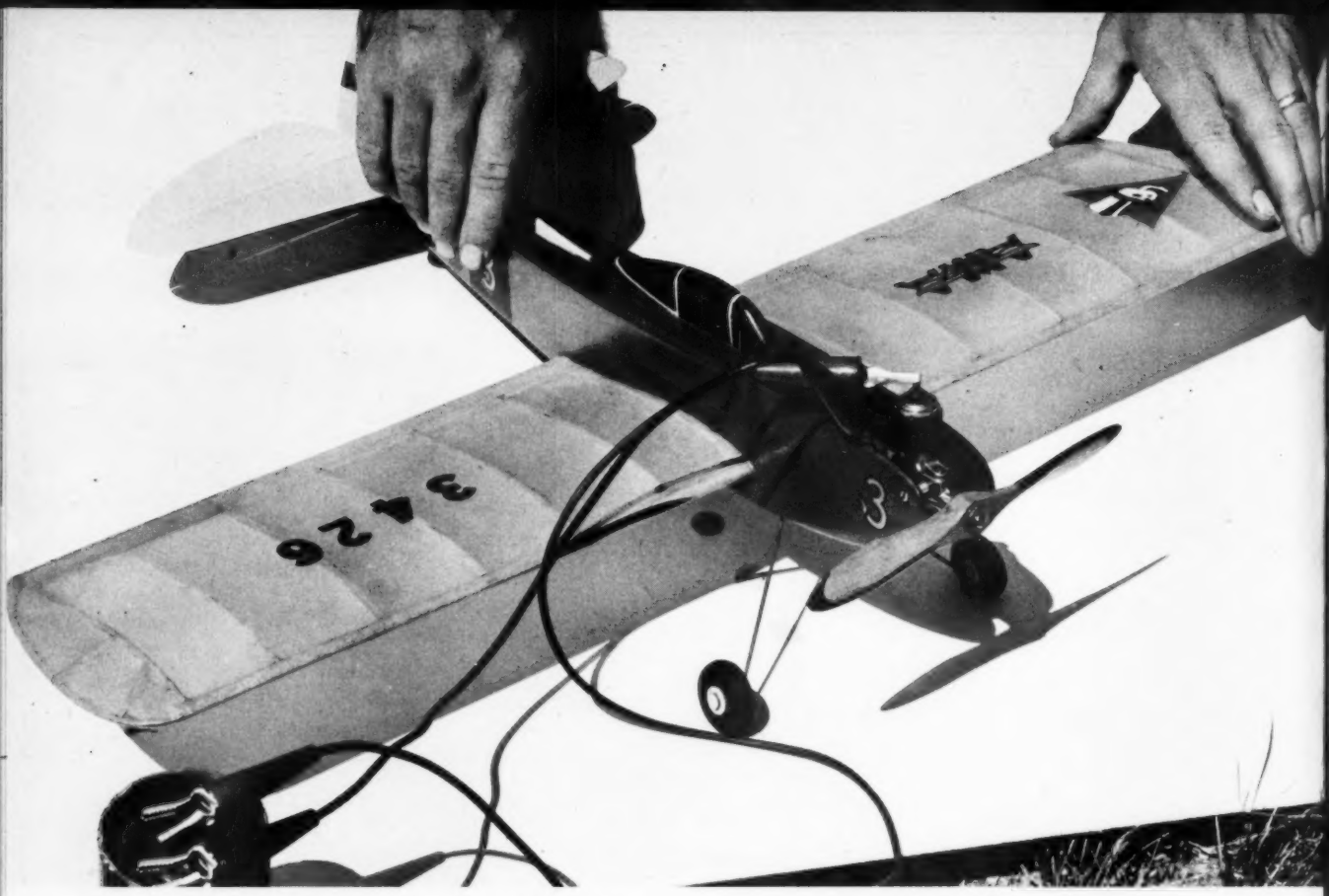
† OUNCES PER SQUARE INCH
‡ OUNCES PER CUBIC INCH

NOTE: IN CERTAIN CASES FIGURES MAY BE CLOSE APPROXIMATIONS RATHER THAN EXACT DATA

Top—Range of sizes for FAI design for .099 engines. Span figures approximate. Above—Years of experience on part of many leading modelers are reflected in this handy reference chart. Below—Range of sizes for FAI design for .15 engines. Bottom—Rigid flying surfaces to minimize warps more frequently is being achieved by these two systems of wing and stabilizer construction. This year's finals were held in England.







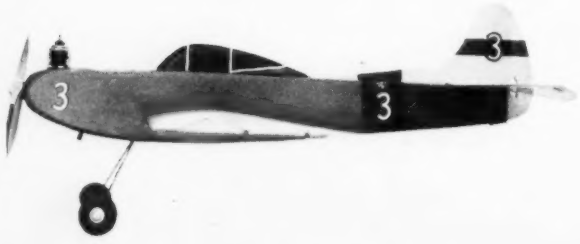
Small edition of big-engined stunters, Spooky features traditional sheet balsa fuselage and built-up wing. But it's easier, cheaper to build.

At same time, it has better ground handling characteristics than the Half-A jobs. Picture shows anti-clockwise rigging—that's up to you.

Spooky

By H. A. WILLIAMSON

Do you scowl at big models? Tilt your nose at little ones? This .09 stunter will please.



One-piece wing slides into cut-out from bottom of fuselage. Opening then built over. Bubble canopy is a block of balsa carved and painted.

Spooky as shown in the photographs is over a year old and still in the prime of life. Figuratively speaking, we've flown the socks off the little rascal, without paying any attention to weather conditions or selection of flying site. This is the way we like to measure the worth of a model! If it can survive the rigors of flight, the merciless poundings and bouncing in the trunk of an automobile, occasional crackups and still come up off the deck and fly, what more can we demand of a ship?

Spooky was actually designed and built in a hurry, to give us some economical fun and relaxation on those long summer evenings. It lived up to and exceeded these design requirements. Many flights have been made in the parking lot of the plant (where we allegedly work) during a 30 minute lunch period. Ever try eating or gulping your lunch at the end of a pair of lines with glow fuel smeared hands? Lotsa fun and raises hob with the digestion!

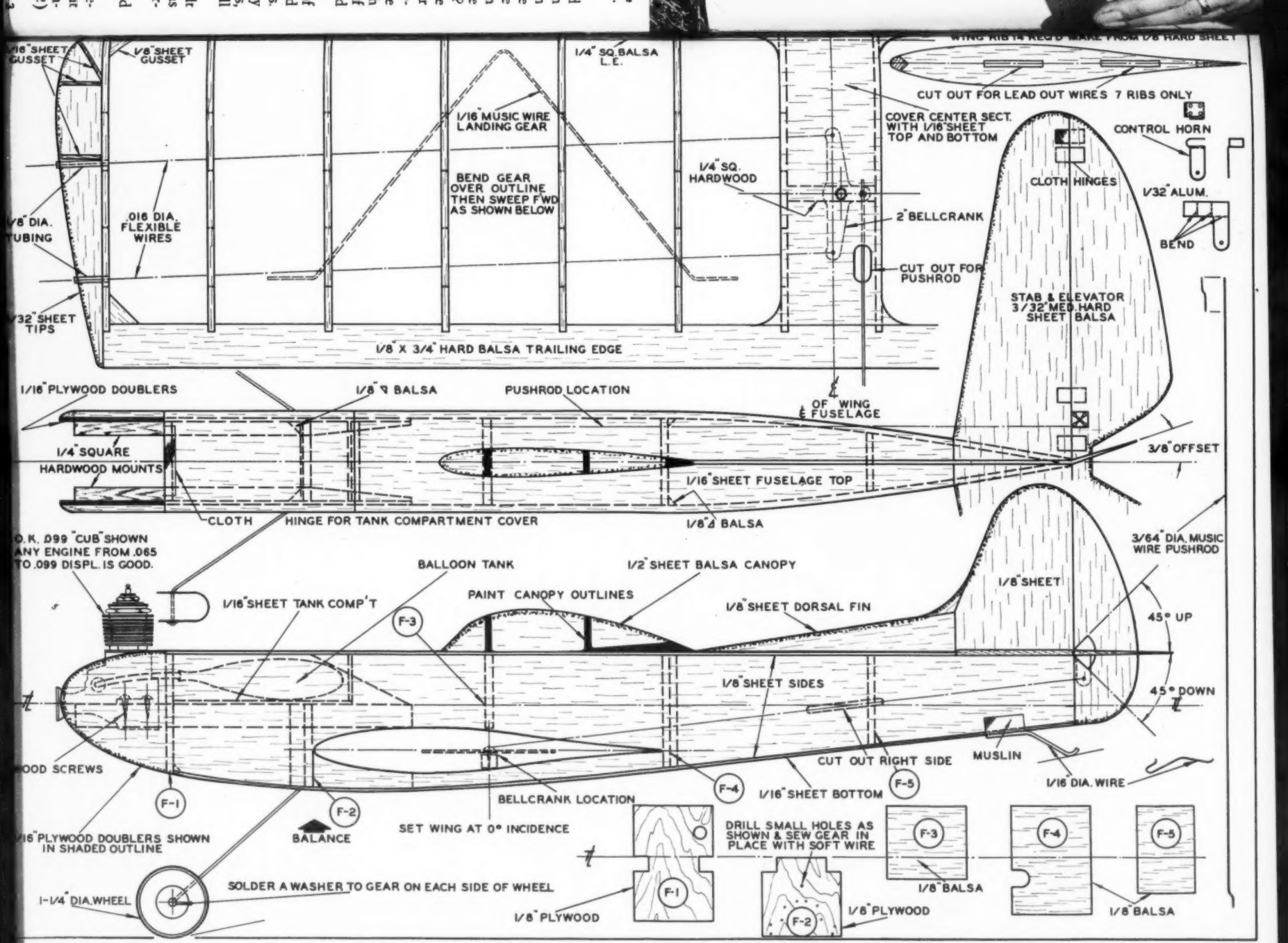
This little ship can be built for an absolute minimum of time, effort, materials and cost. Most of the materials required can be found lying around in the scrap box and unused kits.

Engines from .065 to .099 displacement will provide plenty of sock to do a complete stunt pattern. The .099 powered jobs, if kept to 10 oz. in weight (the original weighs 9 oz.) will be hotter than a Mexican hamburger!

Since Spooky is a "minimum" airplane that can be built in a hurry, it makes a darned good beginner's project and as such is strongly recommended for individual or club undertaking.

Well, don't stand there flat-footed, twiddling your scarred thumbs!

To begin wing construction, trace the rib outline very carefully on a piece of hard cardboard or similar material. Cut this template very accurately. Then use it to produce 14 identical ribs from 1/8 in. thick (*Continued on page* 52)



FULL SIZE PLANS FOR BOTH "SPOOKY" AND "SLOWPOKE" AVAILABLE. SEE PAGE 52.

Watch the birdie

by FRITZ HORN

Soaring birds, such as this hawk, have wing cross sections differing greatly from other bird species. Soarers have the lowest glide angles.

Similarity of wing loading and Reynolds Numbers between birds and model planes have prompted research with startling results. Bird wing-design features were successfully applied by modelers.

Allan D. Cruickshank from National Audubon Society

▸ No model can fly more efficiently than its wing permits. The efficiency of a wing basically depends upon the airfoil employed. All right, then, let's take a high lift foil, slap it on and—Easy! It isn't that simple.

A high lift foil does provide a low sinking speed. But not only the rate of descent determines the efficiency of a cross section. A wing creates lift *and* drag. Consequently, it will be most effective under conditions that insure plenty of lift and very little drag. The relation of lift to drag expresses the angle of glide. It is a function of the altitude lost for every foot of forward motion (Fig. 1).

Full size craft have glide ratios of up to 1:26. For models this value generally does not go beyond 1:17. The difference in efficiency is caused by the direct influence of Reynolds Number on the air flow around the wing. RN equals $\frac{\text{chord x velocity.}}{\nu}$ The Greek letter V (nu) represents the kinematic viscosity of air. At 760mm of mercury and 60° F. its magnitude is 0.143 cm/sec^2. For practical purposes it is sufficient to express RN as *chord x velocity x 70* (where chord is expressed in cm and velocity in cm/sec.), since a division by 0.143 equals a multiplication with 70.

In man-carrying planes, RN ranges from 200,000 to 30,-500,000, and probably over. For models with lower speed and shorter chord, RN extends from 20,000 to approximately 170,000 (Fig. 2).

Air moving around a solid body shows two distinctly different types of flow, depending upon prevailing conditions. At low RN and over smooth, well rounded surfaces, the boundary layer is laminar (Fig. 3). As RN increases a point is approached where the boundary layer changes from laminar to turbulent flow. On an airfoil of conventional design the range of laminar flow is called sub-critical and the turbulent range hyper-critical. The critical point is that at which transition from laminar to turbulent flow occurs.

Fig. 4 shows the distribution of pressure on an airfoil. At about 30 per cent chord the pressure on the upper surface is lowest, because here (*Continued on page* 42)

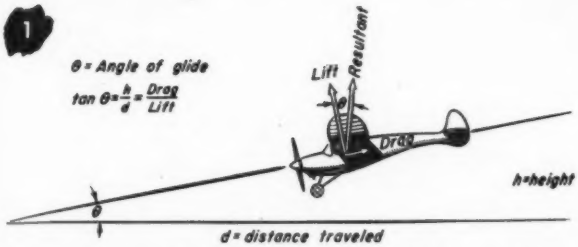
Bird flight long has been the ambition of visionary designers but this remarkable shot suggests why only a few crude ornithopeters have flown.

Robert C. Hermes from National Audubon Society

1

θ = Angle of glide

$\tan \theta = \frac{h}{d} = \frac{Drag}{Lift}$



d = distance traveled

One overall indication of design efficiency is the angle of glide of an airplane. For models this glide ratio may be as high as 17:1; for real planes as high as 26:1. Scale effect (geometric dissimilarity of airflow) is one reason for the greater efficiency of the real plane. This dissimilarity of airflow can be expressed in terms of a "Reynolds' Number," a dimensionless figure, which takes into account the size of the airplane, it's velocity, and the viscosity of the air. Listed in the table below are some representative Reynolds' numbers.

2 *

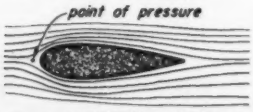
COMPARISON OF REYNOLDS' NUMBERS

	Aver. Chord t (mm)	Speed v (m/s)	R.N. = v × t = 70
Indoor Models	60	2	8,400
	150	4	42,000
Swift	30	6.1	12,800
		39	82,000
Small Models	100	3	21,000
	150	6	63,000
Medium	150	4	42,000
	200	10	140,000
Large	200	4	56,000
	300	10	210,000
Sea Gull	140	10	100,000
Albatross	200	16	224,000
WW-II Fighter	3,000	210	44,000,000

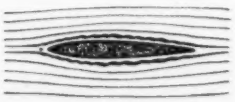
3

As applied to model designing, scale effect describes the change in airfoil characteristics encountered when a real plane section is reduced and used in our comparatively slow flying models. The qualities for which a section was selected may have disappeared; a high L/D section may become very inefficient at low R.N.'s.

Generally speaking, we can categorize flow over an airfoil as either laminar,



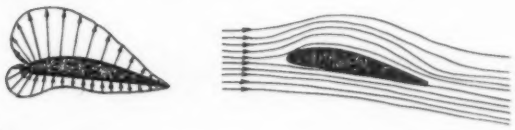
turbulent,



or a combination of the two.

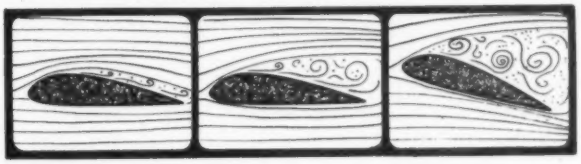
4

For a full-size section the airflow and pressure distribution patterns will be similar to the ones illustrated. Lift will be high, drag comparatively low.



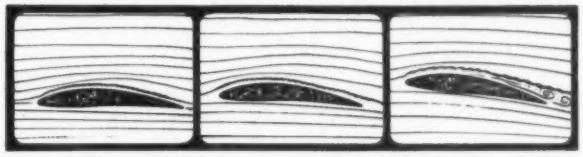
5

However, at low R.N.'s, flow over this same section is no longer the same. At low angles of attack the flow is laminar and detaches itself in large vortices. As the angle of attack increases, burbling becomes worse until the wing stalls out.



6

Studies of airflow over wing sections at low R.N.'s indicate that, in these regions, thin, sharp-nosed sections are most efficient, overcoming the laminar flow problem. The boundary layer is turbulent, adheres to the surface, and only starts to form detaching vortices at high (over 12°) angles of attack.



The table below gives proportions for a representative group of such airfoils.

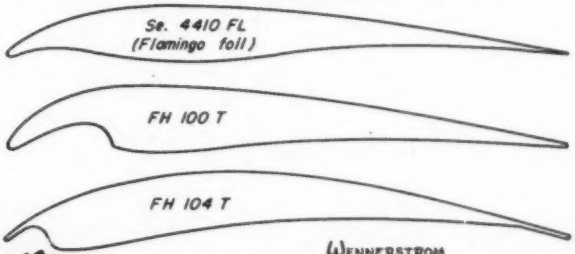
7 *

MAXIMUM MEASUREMENTS FOR TURBULENT BOUNDARY LAYER FOILS

R.N.	Highest Curvature of ℄	Maximum Thickness	Leading Edge Radius
50,000	6 to 9% chord	3% chord	0.4% chord
100,000	6 to 8% chord	6% chord	0.7% chord
200,000	5 to 7% chord	12% chord	1.4% chord

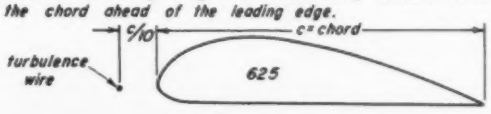
8

Since the wings of birds are essentially low R.N. airfoils, there have been studies made of soaring birds. The albatross, flamingo, etc. all have efficient low R.N. wings. Shown is a cross-section of a flamingo wing and two variations on the theme.



9 *

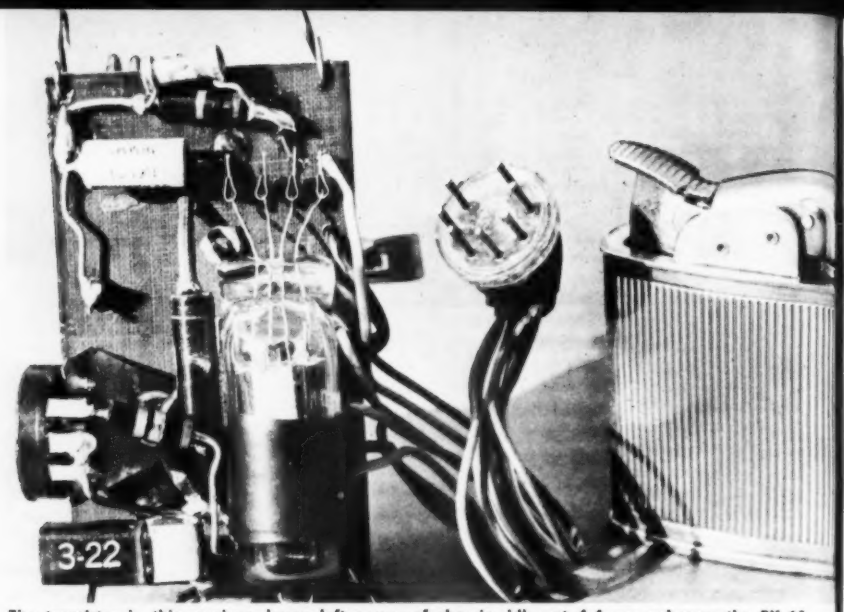
A turbulent boundary layer may also be acheived with a conventional airfoil by using a "turbulance wire," mounted about 10% of the chord ahead of the leading edge.



* Sections indicated have been translated from "Aerodynamik des Flugmodells, Trogfluegelmessungen I" by F. W. Schmitz

Transistors and RC Circuits

by A. L. Morgan



The transistor in this receiver—lower left corner of chassis—idles at 4.4 ma, whereas the RK-61 gas tube is idled at only .4. When the current drops to .1 on signal the transistor drops to 1.4.

Sensational things are expected of transistors but in our field it has been only talk up until now. Here are practical applications.

▸ Recent years have shown a gradual reduction in the size and weight of the average RC model plane. It is readily recognized that smaller models are more easily constructed, can be transported to a flying site without undue difficulty and will endure the rigors of RC flying with a minimum of repair. The size and weight is to a large extent dictated by the radio equipment available. This currently forces most modelers to construct a plane with 5 or 6 sq. ft. of wing area.

Virtually without exception, RC equipment manufacturers have taken advantage of the electronic industries' progress in miniturization of component parts. This has resulted in a condition where the weight of the batteries often exceeds that of the receiver and control surface actuating equipment.

Several years ago the development of the transistor was announced, a device which shows promise of greatly reducing battery requirements. It can amplify much more effciently than the vacuum tube. Since then, development of the transistor and its manufacturing technique have been such that it is no longer a laboratory product but a unit of uniform characteristics which is currently being produced in production quantities.

Transistors are basically of two types, the point contact and the junction. The point contact, which was first developed, consists of two sharply pointed electrodes resting against a minute piece of germanium. This type is more readily suited for high frequency oscillator and amplifier use. The junction type consists of three layers of germanium. It is extremely rugged and its ideal application is as a low frequency amplifier or oscillator requiring only a small operating supply voltage.

Germanium, normally the basic material used in the transistor, may, in its pure form, be considered an insulator. For proper operation, it is necessary that impurities be added, producing a material which is semi-conductive. Dependent upon the impurity employed, the germanium will exhibit

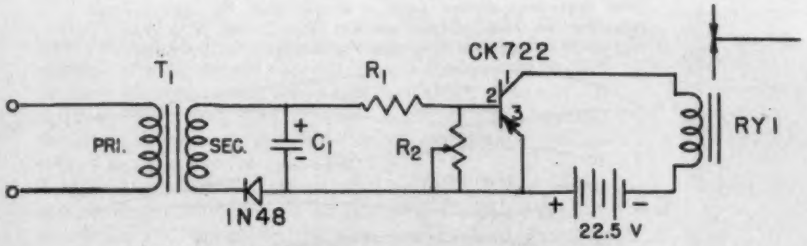
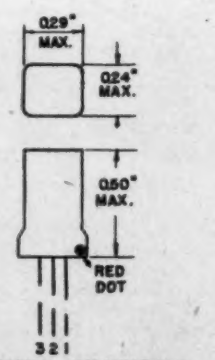


Figure 2. Suggested circuit for a second control from pulse rate change. Transistor requires no filament voltage. Since transistor conducts through a solid, not a vacuum, life may be ten years.



Terminal connections for Raytheon CK-722 transistor. Excess soldering heat to be avoided.

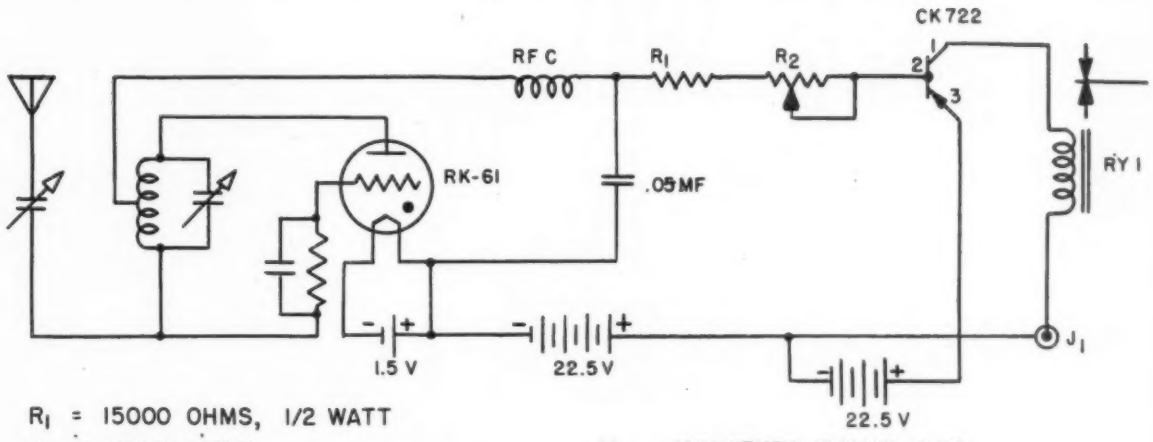


Figure 1. Schematic for receiver shown opposite page. Advantages are long tube life, and reliable relay action due to large current change.

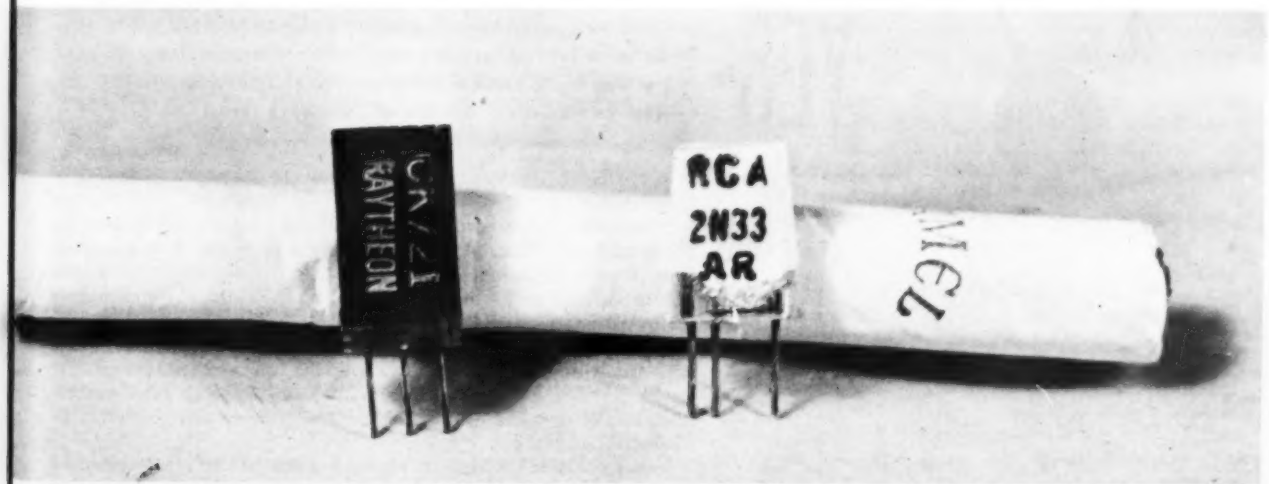
an excess of electrons and be classified as "n" type, or evidence of an electron deficiency will be observed and the material therefore classified as "p" type. These materials now become semi-conductors. In the "n" type passage of current is permitted by the free electrons available, conduction in the "p" type taking place either in the absence of electrons or through "holes" in the germanium. Thus by variation of the alternate layers of germanium, a transistor may be constructed as an n-p-n type or the p-n-p type. Basically the action of the two is the same; however, the polarity of the applied voltages is reversed.

Considering that the transistor has no filament and assuming that it is operated within its maximum ratings, the possibility of its becoming defective is rather remote. There is a gradual deterioration of performance with age. Various methods have been employed to predict its useful life, the resulting answers usually on the order of ten years.

Transistors in general may be compared with triode vacuum tubes in that the emitter corresponds to the cathode, the base to the grid and the collector to the plate. Despite these analogies, their characteristics are considerably different. Conduction is accomplished in a solid rather than in a vacuum, therefore eliminating the necessity of a filament. P-n-p units are operated with the collector negative with respect to the emitter and this voltage is normally much lower than that which would be applied to a tube.

Hearing aid manufacturers immediately recognized the advantages to be gained and some companies employing transistors claim a reduction in battery requirements to one third that previously necessary. Power requirements are so very low that oscillator operation is possible with voltages as low as 1.5 volts and an estimated battery life of several years. Audio oscillators have been demonstrated which were powered from a cell made of a coin, a piece of blotter paper and saliva.

It doesn't seem best that we start saving our nickels and old blotter paper in order to supply power for the RC receiver; however, in time transistors should produce a considerable reduction in battery requirements for the RC plane. Much work lies ahead in future development of transistor circuitry and yet considerable progress has already been made. Audio amplifiers which employ *(Continued on page 45)*



Two transistors for size comparison. One on the left is a junction type—one on right is point contact type suitable for 50 mc oscillator operation. Transistors in general may be compared with triode vacuum tubes: emitter corresponds to cathode, base to grid, and collector to plate.

KEEP THAT GASSIE SPIN-PROOF

These ideas trespass on sacred theories but the author states

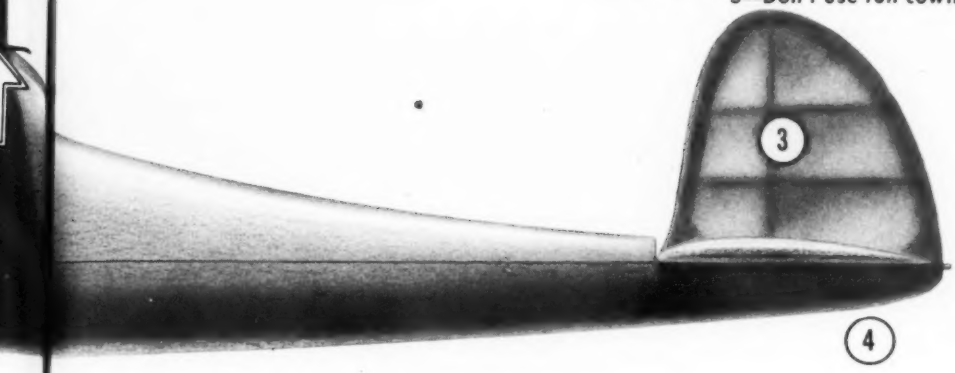
YES

1—Minimize pylon area in front of balance point.
2—Balance farther forward and use smaller stabilizer.
3—Put one-third vertical tail area into sub-rudder.
4—Reduce side area forward of CG above thrust line.

by C. O. WRIGHT

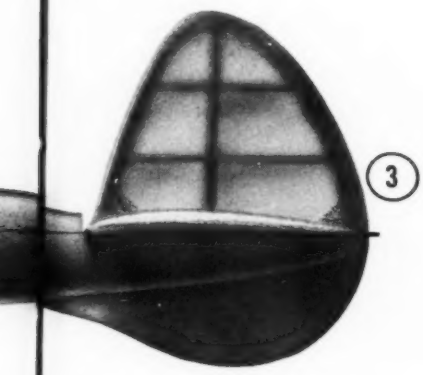
▸ Advice on spin-proofing a free flight gas model under power, by one with a full quota of pile-ins, may seem improper. It is admitted, that the subject is approached with some quaking of the knees. The experience in 1949 at Olathe Nationals on both A and B days led to observation, study and experimentation on the power spin-in problem with results reported in this article. Application of the suggestions offered resulted in no pile-ins for a year in either testing or contests, including flights in all four free flight gas classifications at Dallas, some of which were made under most unfavorable weather conditions.

It is frankly acknowledged also that some of the ideas presented here trespass on some sacred theories, and may bring violent disagreement from some modelers over the country. Nevertheless, the


NO
1—Avoid large, high, forward profile area.
2—Don't balance near trailing edge (result of large stab).
3—Don't place total rudder above thrust line.
4—Don't leave off sub-rudder.
5—Don't use full cowling.
3
4

Author and Fantail-33. Stable, any prop and rpm, due small pylon area, center rudder, big sub-rudder. "C.O." has been flying them since first World War.

that these do's and don'ts will stop many an unnecessary smash.

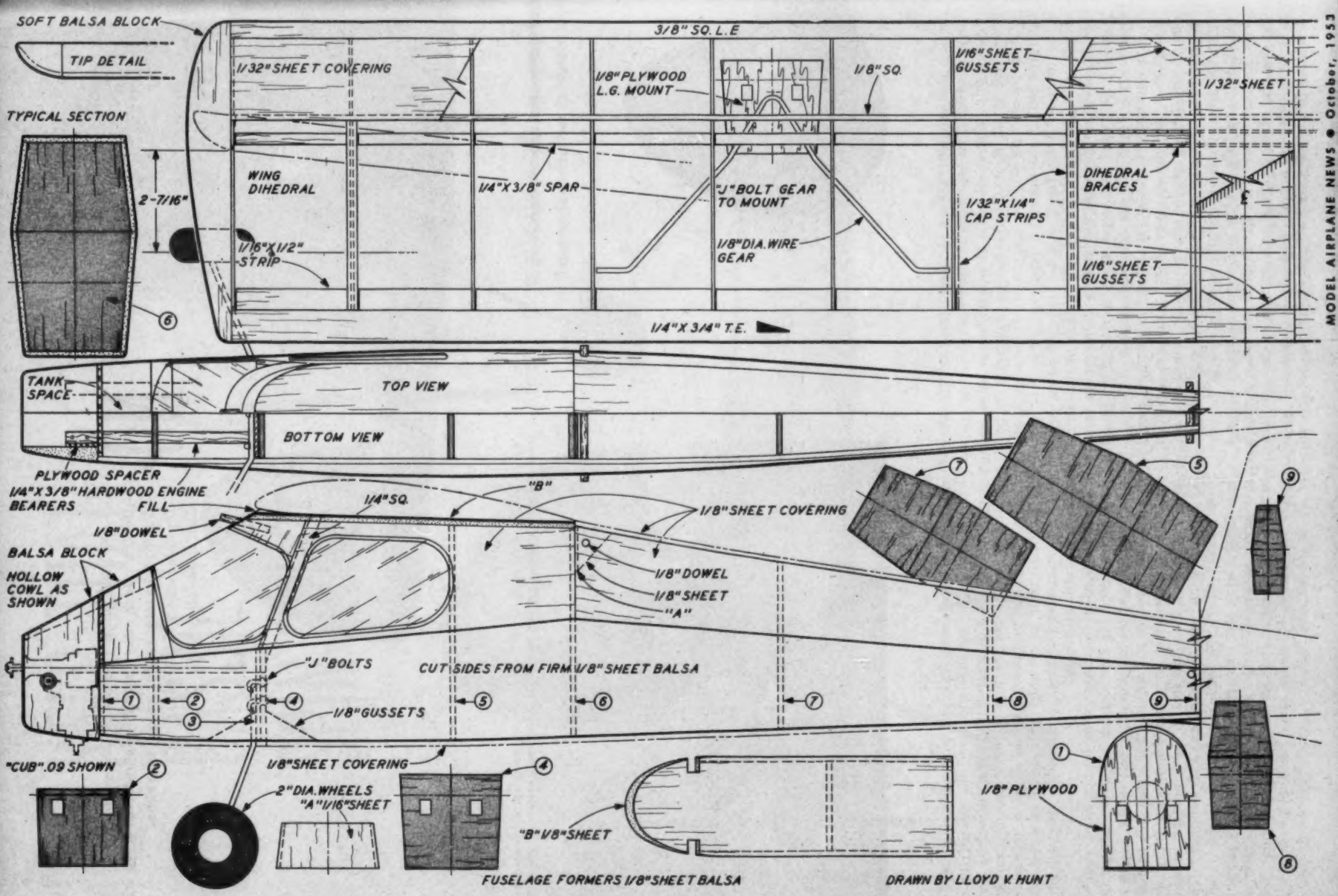


neck is well extended, and the ideas are offered for what they may be worth. The fact faces us, there have been too many discouraging pile-ins. If they can help the situation and save a few ships, let the critics talk their loudest and longest. Maybe the experts will be encouraged to give us a real spin-free job, if the discussion progresses.

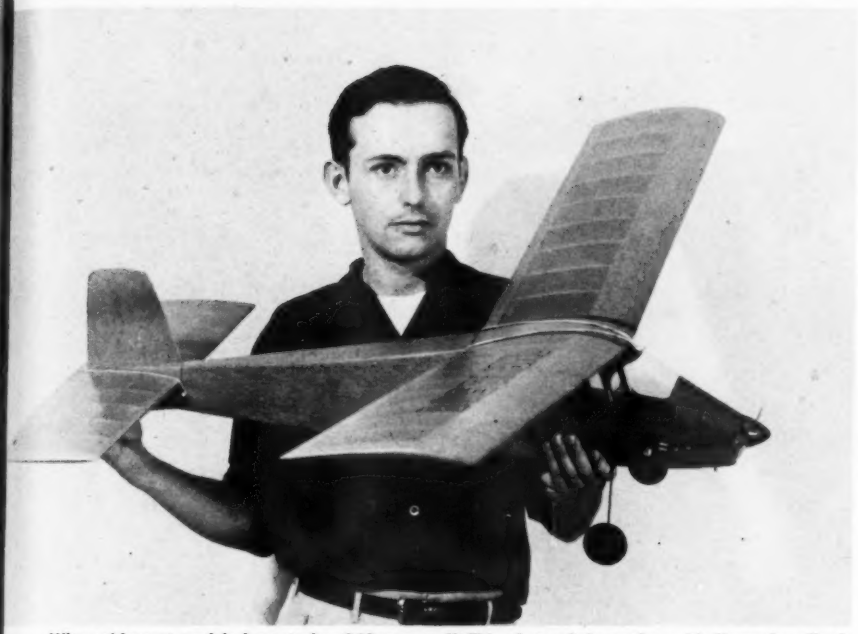
For over ten years the author has concentrated on pylon design with gas power, and the suggestions in this article are applicable only to parasol craft with power in front. Shoulder wings and low wings, conventional rubber model designs and gliders are out of the discussion.

There are many forces at play when the pylon gas model skyrockets upstairs on its power flight. The most important one in the power spin-in problem is the propeller wash. When the propeller slips as it pulls in the air, a sizable breeze from the prop spirals around the fuselage, hitting the side of the pylon and the side of the center rudder. This prop wash "corkscrew" has a left hand thread, and when it strikes the side area of the pylon it pulls the ship to the right. The prop wash continues to spiral back to the rudder, and when it strikes the rudder it tends to pull the ship to the left. In the process there are at least two pivoting points: at the balancing point of the ship and along the line of thrust. It is clear that the side areas of the pylon, as well as their areas above and below the line of thrust, are of great importance. A proper portioning of these areas, in relation to the balancing point of the ship and the line of thrust *as it makes its imaginary line through the rudder area*, will produce a spin-resistant design.

In the days when there were wing loading rules, some of the designers used big elevators, up to 50 per cent of the wing area, to have the elevator carry part of the weight of the ship. This practice still survives but serves only to make the ships more sensitive on power adjustment. Wing area is now unlimited. Place the area in the wing (let the wing do the lifting and the elevator be just a stabilizer). The large elevator places the balancing point near the trailing edge of the wing and tends to produce a spirally unstable ship under power. A stable ship will carry its center of balance at or near the center of lift of the wing. This means the correct balancing point on a pylon ship will be 50 or 60 per cent back (*Continued on page 54*)



FULL SIZE PLANS FOR BOTH "SPOOKY" AND "SLOWPOKE" AVAILABLE. SEE PAGE 52.



Who said sport models have to be .049 powered? This photo of the author with Slowpoke affords an excellent impression of size. Note Spitfire timer. Its performance is well suited to small fields.

Slowpoke

BY LLOYD V. HUNT

Why tear out your hair trying to sport-fly contest models? When trophies are not at stake, enjoy life with this good looking cabin free flight. Features .09 power.

Most sport model designs conform to the conventional layouts of the box type fuselage and typical "light plane" cowling configurations. But in this model we have tried to present a design that is different yet rewarding to construct and fly.

Over-all size of the model was determined by the engine, a Cub .099. With slight modifications our model may be powered with any class A engine such as the Arden or McCoy .099, etc.

Our model has a wing area of nearly 382 sq. in. and a power loading of 274 oz. Incidentally, the Slowpoke could possibly be used as a radio control job.

In general the structure is quite simple, but prospective builders should be careful to pick only medium balsa throughout, with the exceptions of the fuselage formers, spars, leading and trailing edges of the wings and horizontal stabilizer, which should be hard. Fuselage construction is started by cutting the two sides to outline. The location of each former should be carefully marked on the inside of each side. Starting with the widest former which is No. 6, cement the two sides and the former together, pinning them in place. The assembly should be true and square. The other formers can be then cemented in, one by one, held with pins if necessary. The basic fuselage is now completed and requires only the 1/8 in. plywood firewall and the 1/8 in. plywood landing gear mount to be double cemented in place.

Before cementing the firewall to the fuselage, make provisions to install the tank. Use your own ideas on installation for this, as the required size rests on your engine and own preference. A Spitfire timer may also be used in this installation for power flights. After bending the 1/8 in. diameter wire landing gear and J-bolting to the landing gear mount, cut three holes into former No. 4 to facilitate secure mounting. Lastly, cement to the inside of the fuselage sides the 1/8 in. sheet gussets as shown on the drawing.

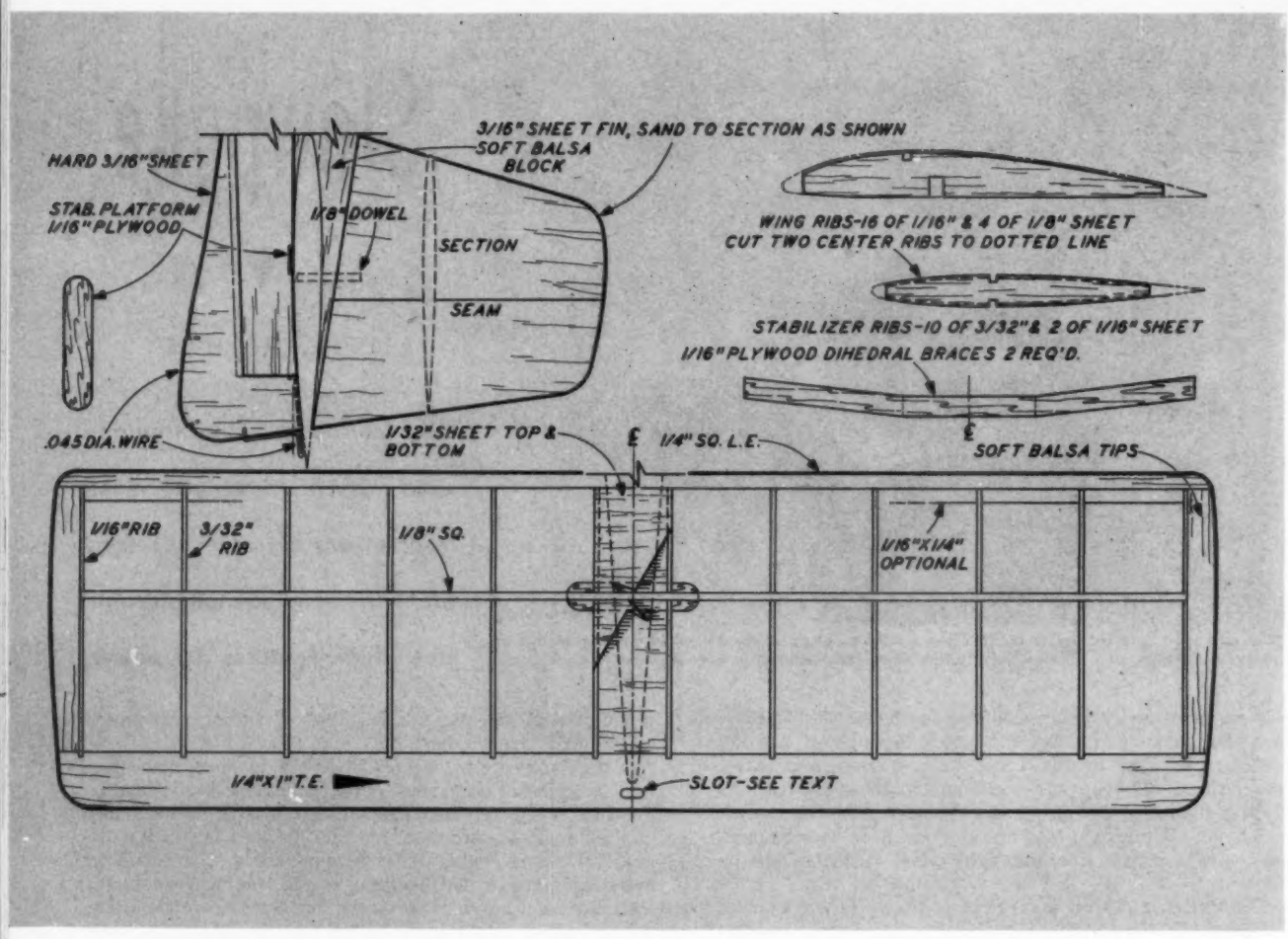
The cabin structure is begun by cementing former A to the aft side of former No. 6. Then add the dowel gussets to the inside of the fuselage. Former B is located and cemented to 5 and 6. Finish by cementing in place the two 1/4 sq. in. strip cabin braces. Check this assembly before covering the top half of the fuselage sides. Bevel the 1/8 in. sheet coverings to assure better cementing of the balsa to the sides, as well as a clean seam.

A pattern for the cabin windows may help in cutting them to outline. Cement the dowel in place aft of former No. 6 before covering the top and bottom of the fuselage. We covered the bottom up to former No. 4, then used a hard wood

Continued on next page

Something new and different. The inverted .09 enhances looks but the builder may mount the engine upright if he prefers. Can carry radio, too.

Rear quarter view emphasizes simple lines and the obvious benefits of a combination of sheet balsa and built-up construction. Built to take it!


3/16" SHEET FIN, SAND TO SECTION AS SHOWN
SOFT BALSA BLOCK
HARD 3/16" SHEET
STAB. PLATFORM 1/16" PLYWOOD
1/8" DOWEL
SECTION
SEAM
WING RIBS-16 OF 1/16" & 4 OF 1/8" SHEET
CUT TWO CENTER RIBS TO DOTTED LINE
STABILIZER RIBS-10 OF 3/32" & 2 OF 1/16" SHEET
1/16" PLYWOOD DIHEDRAL BRACES 2 REQ'D.
.045 DIA. WIRE
1/32" SHEET TOP & BOTTOM
1/4" SQ. L.E.
SOFT BALSA TIPS
1/16" RIB
3/32" RIB
1/8" SQ.
1/16" X 1/4" OPTIONAL
1/4" X 1" T.E.
SLOT-SEE TEXT

Continued from preceding page

insert between the gears before covering the rest of the bottom. Complete the fuselage by mounting the plywood stabilizer platform, then cut and shape the cowling aft of the firewall. Also cement in place the balsa block under former B. Trim to shape, then finish by contouring with sandpaper. Cement the dowel in this part. Finish the cabin with remaining details.

The engine and spinner are fitted only temporarily while the remaining cowling is formed. This may be cut from a balsa block and hollowed out to a 1/4 in. wall, or may be formed by using 1/4 in. sheet for the two bottom portions and a balsa block for the top. The cowling may be held in place by pegs or dress snaps or by any way that you wish. Drill a hole into the cowling for the needle valve and one for the fuel line to pass through.

Build the two wing panels separately, then the center section. Be sure that you use hard 1/8 in. sheet balsa for the four ribs at the center section, omitting the two ribs on the wing panels until the plywood dihedral braces have been cemented in place. Pin the trailing edge to the plan, then cement the 1/16 x 1/2 in. filler strip to the trailing edge. Then locate the main spar. Cement the ribs over the spar and onto the filler strip and the trailing edge. Next cement the leading edge in place against the ribs. Place strips of scrap balsa under the leading edge to raise to the proper height. Cement the panels to the center section, then add the dihedral braces. Finish by cementing the remaining 1/8 in. ribs to the center section. Cement the 1/8 sq. in. spars to the top of the ribs. Allow the complete structure to dry before covering the leading edge with the 1/32 in. sheet balsa, and then cap the ribs. Form the wing tips from two balsa blocks to contour and cement in place. Add the gussets in the center section. Cover as shown.

The leading and trailing edges of the horizontal stabilizer should be pinned down to the plan along with the bottom 1/8 sq. in. spar. Block up the leading and trailing edges with scrap balsa to allow for correct positioning of the ribs. After the assembly has dried, complete by covering the center section with 1/32 in. sheet and cement the tips in place. The trailing edge may be slotted as shown to secure the parts to the fuselage. The soft balsa block over the horizontal stabilizer may now be finished and added.

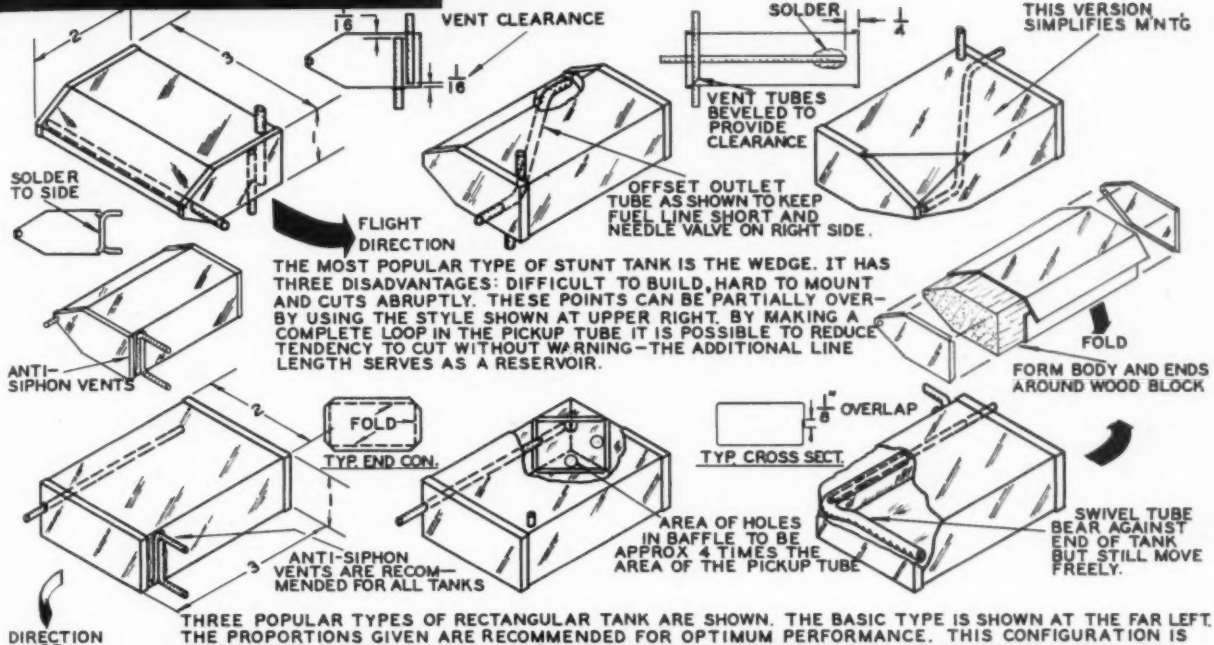
Cut the vertical stabilizer from 3/16 in. sheet and sand to a streamlined section. This is secured to the fuselage block and the horizontal stabilizer by using a dowel and then cementing to the top. The sub-rudder is shaped in the same manner as the horizontal stabilizer. Bend the skid and the wire hook and cement to the sub-rudder. Locate the 1/8 in. dowel into the fuselage, near the leading edge of the horizontal stabilizer.

With the assembly completed, sand to final form preparatory to covering to insure a good clean finish. Fuelproof the inside of the cowl and the fuselage, and even the wing. Color, dope, or finish the model by trimming to whatever design you wish. We finished ours in red.

The model should balance about 1/3 in. back from the leading edge of the wing. Test glide with a gentle shove. After you are satisfied with the glide, try short power flights, using about one-third power and a short timer run for the first few flights. An ROG getaway will prove most realistic. Power flights may range from 30 or 40 seconds—that is, if they do not get enough height.

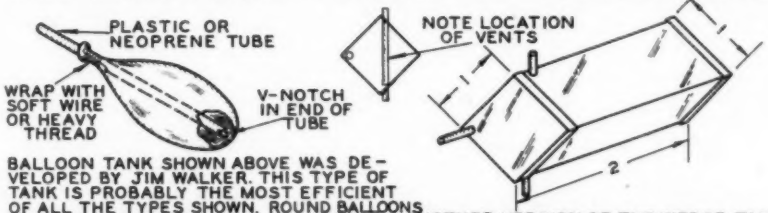
design detail

Stunt Tanks


VENT CLEARANCE
SOLDER
THIS VERSION SIMPLIFIES M'NTG
VENT TUBES BEVELED TO PROVIDE CLEARANCE
SOLDER TO SIDE
OFFSET OUTLET TUBE AS SHOWN TO KEEP FUEL LINE SHORT AND NEEDLE VALVE ON RIGHT SIDE.
FLIGHT DIRECTION
ANTI-SIPHON VENTS
FOLD
FORM BODY AND ENDS AROUND WOOD BLOCK
FOLD
TYP. END CON.
OVERLAP
TYP. CROSS SECT.
AREA OF HOLES IN BAFFLE TO BE APPROX 4 TIMES THE AREA OF THE PICKUP TUBE
SWIVEL TUBE BEAR AGAINST END OF TANK BUT STILL MOVE FREELY.
ANTI-SIPHON VENTS ARE RECOMMENDED FOR ALL TANKS
DIRECTION OF FLIGHT

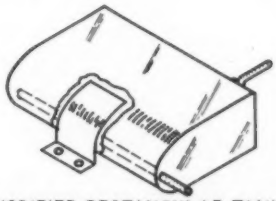
THE MOST POPULAR TYPE OF STUNT TANK IS THE WEDGE. IT HAS THREE DISADVANTAGES: DIFFICULT TO BUILD, HARD TO MOUNT AND CUTS ABRUPTLY. THESE POINTS CAN BE PARTIALLY OVER-BY USING THE STYLE SHOWN AT UPPER RIGHT. BY MAKING A COMPLETE LOOP IN THE PICKUP TUBE IT IS POSSIBLE TO REDUCE TENDENCY TO CUT WITHOUT WARNING—THE ADDITIONAL LINE LENGTH SERVES AS A RESERVOIR.

THREE POPULAR TYPES OF RECTANGULAR TANK ARE SHOWN. THE BASIC TYPE IS SHOWN AT THE FAR LEFT. THE PROPORTIONS GIVEN ARE RECOMMENDED FOR OPTIMUM PERFORMANCE. THIS CONFIGURATION IS SUPERIOR TO THE WEDGE TANK IN MOST RESPECTS. IT OFFERS SIMPLER CONSTRUCTION AND IS MORE EASILY MOUNTED. THE CENTER SKETCH SHOWS A MODIFIED VERSION EMPLOYING A BAFFLE TO REDUCE FUEL SURGE DURING ABRUPT MANUEVERS. AT THE FAR RIGHT IS SHOWN WALT HUGHES "CLANK" TANK. THE SWIVEL ACTION OF THE PICKUP TUBE INSURES A CONSTANTLY UNIFORM FLOW OF FUEL REGARDLESS OF ATTITUDE OR SPEED. THIS TYPE IS HIGHLY RECOMMENDED FOR SHIPS WITH ENGINES WITH DISPLACEMENTS FROM .199 AND UP.

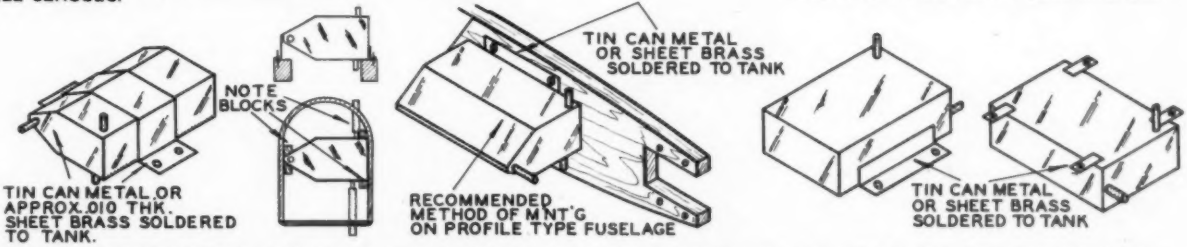


BALLOON TANK SHOWN ABOVE WAS DEVELOPED BY JIM WALKER. THIS TYPE OF TANK IS PROBABLY THE MOST EFFICIENT OF ALL THE TYPES SHOWN. ROUND BALLOONS SHOULD ALWAYS BE USED. THE SIZE IS DEPENDENT UPON THE ENGINE CLASS. TANK IS FILLED BY INSERTING SYRINGE OR PUMP IN END OF FILLER TUBE. ALL AIR THAT BECOMES TRAPPED INSIDE MUST BE BLED OFF TO ASSURE PROPER OPERATION. HIGHLY RECOMMENDED FOR ALL CLASSES.

ANOTHER VERSION OF THE WEDGE TANK WHICH IS ACTUALLY A SQUARE TANK SET ON EDGE. IT S EASIER TO MOUNT THAN THE MORE CONVENTIONAL WEDGE—THIS TYPE CUTS VERY ABRUPTLY AND DOES NOT FEED PROPERLY DURING TIGHT, FAST MANUEVERS.



A MODIFIED RECTANGULAR TANK WITH WITH OUTSIDE ROUNDED. THIS TYPE FEEDS A LITTLE MORE POSITIVELY THAN THE BASIC RECTANGULAR TANK AND IS LESS SUBJECT TO CHANGES IN SPEED. THIS TYPE IS FAIRLY DIFFICULT TO BUILD AND IS NOT GENERALLY RECOMMENDED.

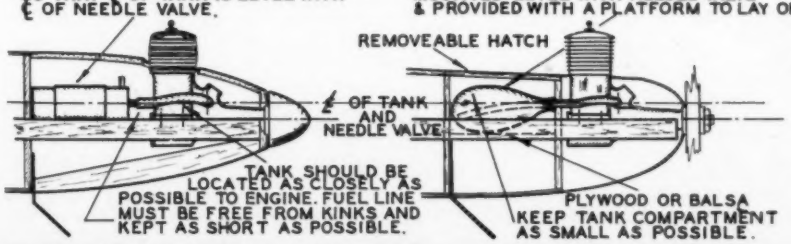

NOTE BLOCKS
TIN CAN METAL OR APPROX .010 THK. SHEET BRASS SOLDERED TO TANK.
TIN CAN METAL OR SHEET BRASS SOLDERED TO TANK
RECOMMENDED METHOD OF M'NT'G ON PROFILE TYPE FUSELAGE
TIN CAN METAL OR SHEET BRASS SOLDERED TO TANK

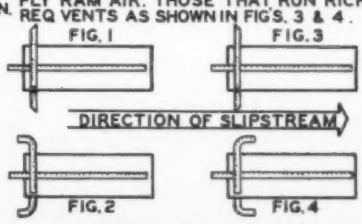
SEVERAL METHODS OF TANK MOUNTING ARE SHOWN ABOVE. CHOICE IS LARGELY DEPENDENT UPON THE TYPE OF MODEL. IN GENERAL—TANKS SHOULD BE SECURELY MOUNTED IN A LEVEL POSITION TO INSURE A UNIFORM FUEL FEED.

NOTE THAT TANK IS MOUNTED SO THAT ℄ OF TANK IS LEVEL WITH ℄ OF NEEDLE VALVE.

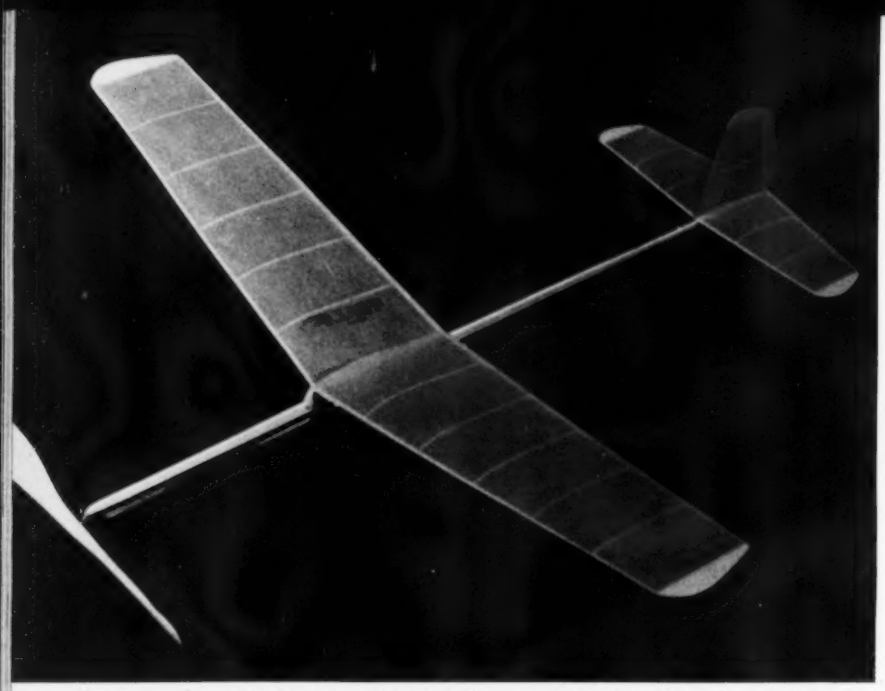
BALLOON TANKS SHOULD ALSO BE MOUNTED LEVEL WITH NEEDLE VALVE & PROVIDED WITH A PLATFORM TO LAY ON.

ENGINES THAT RUN LEAN SHOULD HAVE ARRANGED AS SHOWN IN FIGS. 1 & 2 TO SUPPLY RAM AIR. THOSE THAT RUN RICH, MAY REQ VENTS AS SHOWN IN FIG'S. 3 & 4.


REMOVEABLE HATCH
℄ OF TANK AND NEEDLE VALVE
TANK SHOULD BE LOCATED AS CLOSELY AS POSSIBLE TO ENGINE. FUEL LINE MUST BE FREE FROM KINKS AND KEPT AS SHORT AS POSSIBLE.
PLYWOOD OR BALSA KEEP TANK COMPARTMENT AS SMALL AS POSSIBLE.



HARRY-A. WILLIAMSON



Twenty years ago, Don Donahue used to fly half-ounce stick jobs like this one in competition. They floated like a "feather," says the author, and had a contest average of ten minutes; hit 30 minutes.

FEATHER

by DICK EALY

Do you think model building should be fun? Then build, fly, this simple high flier.

▶ This outdoor stick model is a duplicate of a championship model developed by Don Donahue in the early 1930's when duration flying was in the exploration stage. Don built this model for us. It is an airplane that will reward the novice with long thermal flights, and some of you advanced builders will get a kick out of chasing Feather cross-country.

At the time Don's first model was built, there were no weight restrictions; you could build anything for competition. This was good for us novices not used to handling a lot of power. Don's ship had 90 sq. in. wing area and weighed only 1/2 oz., so that it floated like a feather on the slightest thermal for flights that lasted an average contest time of 10 minutes, and sometimes as high as 30 minutes.

Make wing frame first. Leading edge is 1/8 in. sq., tapered as shown. Trailing edge is 3/32 x 1/4 in. balsa, tapered as shown. Cut spars and ribs from medium balsa. Pin frame down and cement. Trim spar ends and cement 1/16 in. sheet balsa tips. Notch spars at center and raise tips 2-1/2 in. on each side and cement. Wing mount is a 3/16 x 3/8 x 4-3/4 in. balsa core with 1/32 in. sheet cemented to each side. Grain runs horizontally on core, vertically on sides. Cement to wing. Cover with Jap tissue, using clear dope for adhesive.

Tail and rudder frames are made next. Cover with tissue. Cement rudder to tail with 1/8 in. left offset.

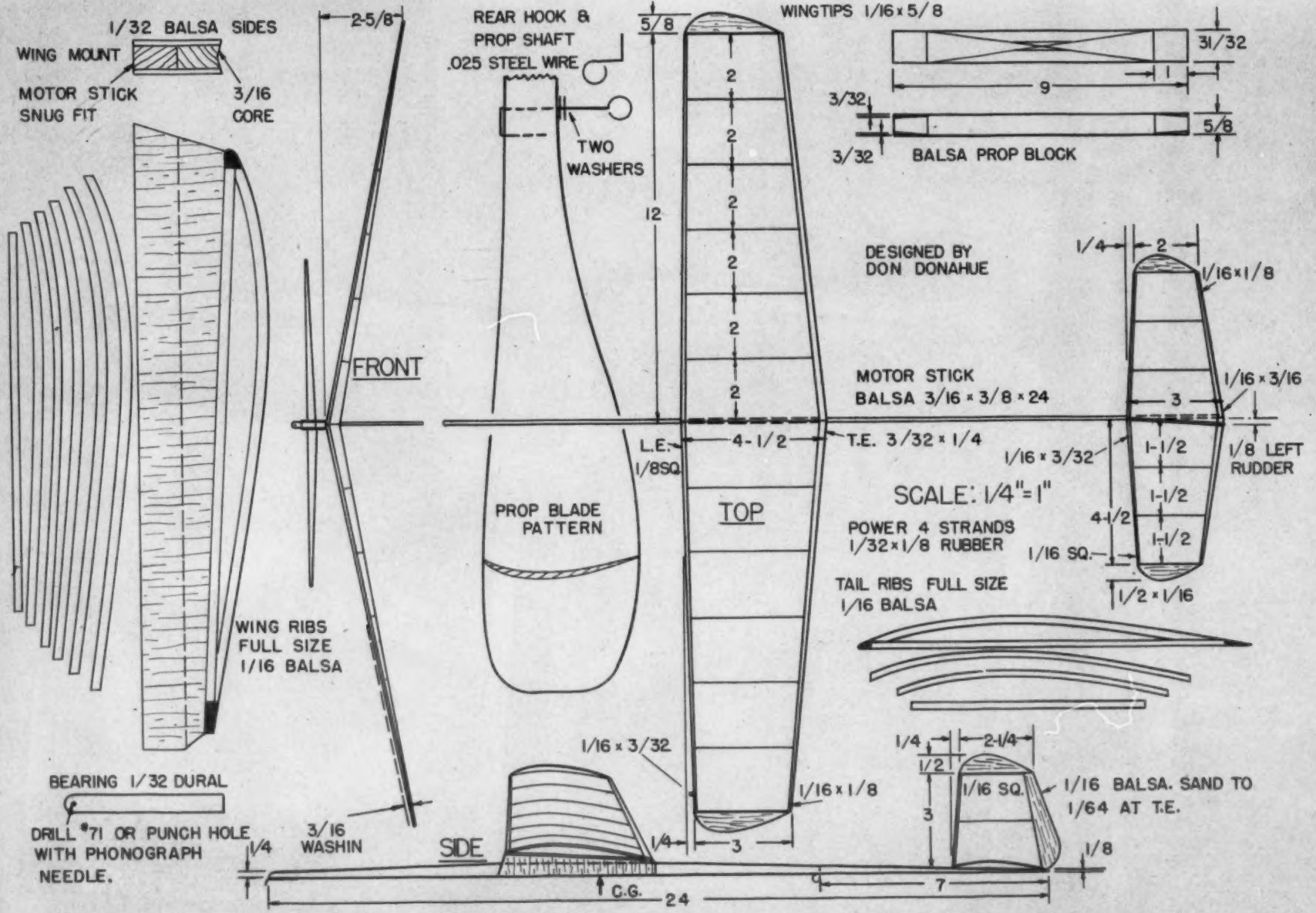
Motor stick is 3/16 x 3/8 x 24 in. medium balsa, tapered. It is straight on bottom. Make thrust bearing and cement with three coats to motor stick. Thread may be used to lash it. Bend rear wire hook and cement in place. Cement tail on top of motor stick.

Propeller block measures 5/8 x 9 x 9 in. Draw lines on block as shown and carve away to lines. Carve underside of blade and sandpaper it smooth. Then carve top side of blade, and sandpaper. Use full size template to trim blade edges. Sand with 1/0 and then finish with #400. Bend wire shaft and insert through rear of prop. Bend front end over, force into prop and cement. Place two washers on shaft and insert shaft through hole in thrust bearing.

Rubber motor is four strands, 1/8 x 1/32 in. and 17 in. long. Find balance point of assembled stick and place wing over this so that a point 2/3 in. back of leading edge is above. Hand glide model and trim by moving wing forward if nose-heavy, or back if tail-heavy. Rudder trailing edge can be warped to tighten left circle.

List of materials. (All wood is medium hard; all measurements are in inches). One piece 1/8 sq. balsa x 36; one piece 3/32 x 2 x 36; one piece 1/16 x 2 x 36; one piece 3/16 x 3/8 x 36; one block 5/8 x 31/32 x 9; (or machine carved prop.); one piece 1/32 x 3 x 4; one piece .025 dia steel wire x 3; one thrust bearing; two washers; one sheet Jap tissue; 1 oz. clear dope; one tube cement; rubber, 1/32 x 1/8 x 68. Obtain these from your dealer.

For adjustments move wing back and forth—for tighter turn, warp the rudder slightly. Jap tissue applied with dope adhesive; leave surface undoped. Four-strand motor and 9-inch prop gets it up thar.


1/32 BALSA SIDES
WING MOUNT
MOTOR STICK SNUG FIT
3/16 CORE
2-5/8
FRONT
REAR HOOK & PROP SHAFT .025 STEEL WIRE
TWO WASHERS
5/8
12
2
2
2
2
2
2
WINGTIPS 1/16 x 5/8
31/32
1
9
3/32
5/8
3/32
BALSA PROP BLOCK
DESIGNED BY DON DONAHUE
1/4
2
1/16 x 1/8
MOTOR STICK BALSA 3/16 x 3/8 x 24
1/16 x 3/16
3
1/8 LEFT RUDDER
L.E. 1/8SQ.
4-1/2
T.E. 3/32 x 1/4
1/16 x 3/32
1-1/2
1-1/2
1-1/2
4-1/2
1/16 SQ.
SCALE: 1/4"=1"
POWER 4 STRANDS 1/32x1/8 RUBBER
TAIL RIBS FULL SIZE 1/16 BALSA
1/2 x 1/16
PROP BLADE PATTERN
TOP
WING RIBS FULL SIZE 1/16 BALSA
BEARING 1/32 DURAL
DRILL #71 OR PUNCH HOLE WITH PHONOGRAPH NEEDLE.
3/16 WASHIN
SIDE
1/16 x 3/32
1/16 x 1/8
1/4
3
1/4
2-1/4
1/2
1/16 SQ.
3
1/16 BALSA. SAND TO 1/64 AT T.E.
1/8
C.G.
24
7

Be sure you have the right cement for the job to be done —

FORMULA "A"

Extra-fast-drying for quick easy construction of light weight models and for on-the-spot repairs. Guaranteed Hot Fuel Proof.

FORMULA "B"

Fast-drying; the *strongest* for balsa or hardwood . . . for metal to metal . . . for metal to wood . . . for all general work.

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TESTORS

For modelers who want the best

FORMULA "A"

FORMULA "B"

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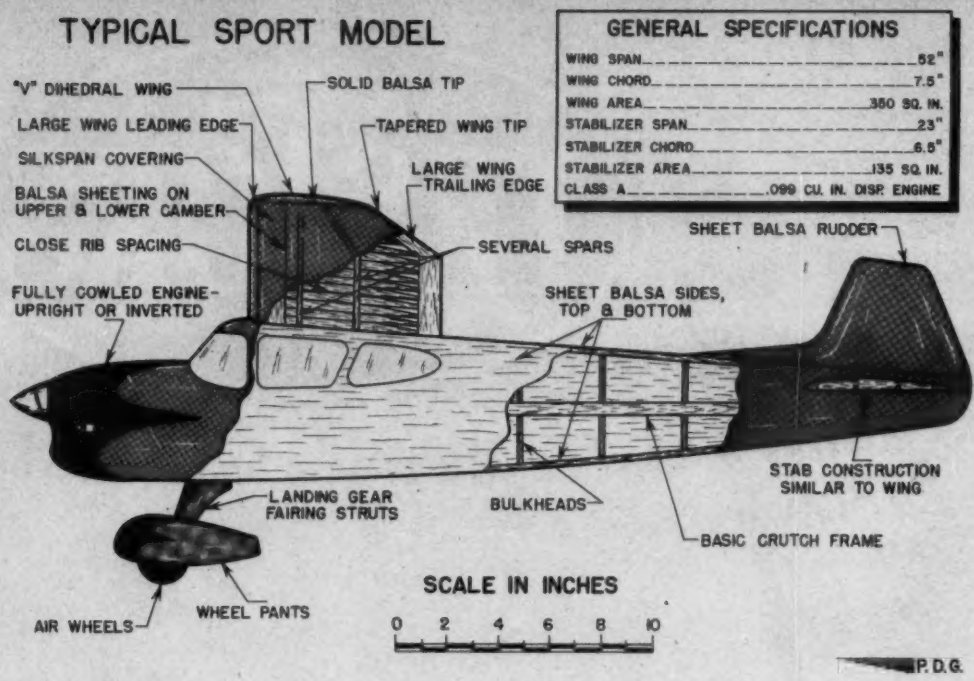


Higher wing loadings in conjunction with higher power loadings (less power) make possible sturdier structures, better details, for sport jobs.

SMALL Field Models

▸ In submitting to manufacturers, editors, and the Academy of Model Aeronautics sample rules for a proposed new free flight event, Dallas Sherman, father of the PAA Load model event, pointed out an uncomfortable truth.

"If free flight models aren't tamed to fly within reasonably restricted size areas (as found in or relatively near cities)," stated Sherman, "then free flight is due for slow but certain death from non-activity—not to solve this problem would be a many-sided tragedy."

While the vanishing flying site has been a problem since well before the war, and is now acute, the only "solution" found so far is to travel to a flying site still farther from town. When this is impractical, the contest minded flier hopes to do his adjusting on the day of the contest, and the

Stolzenberger's Swoose: Infant area, .09. Fast water-skimming landings.

Scaled up, dry land version of Drake, by Pete Hartzell. Elfin powered.

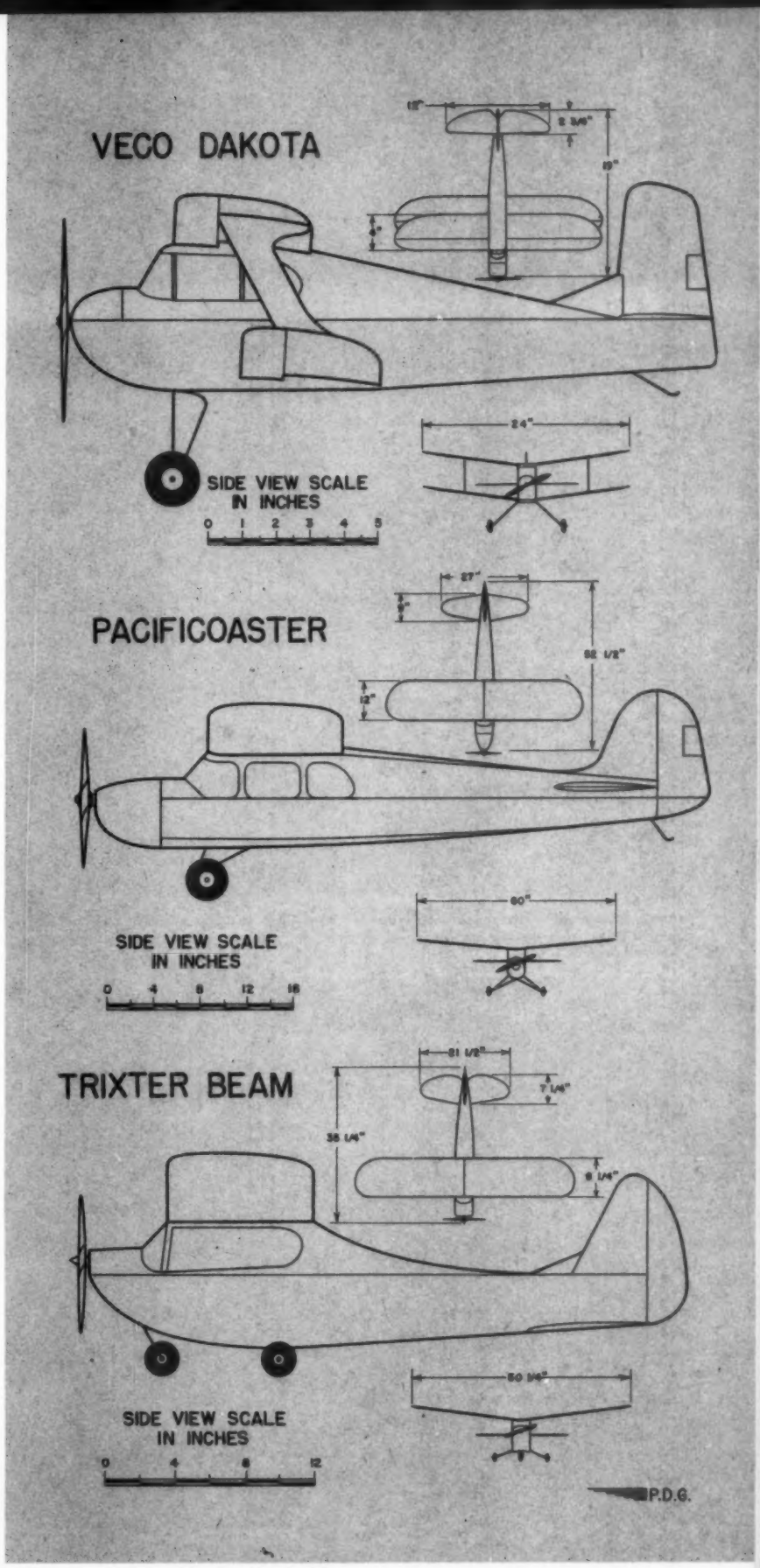
The high climbing contest model is not for sport, as distracted Sunday fliers know. So if you lack a prairie to fly on, try this approach in your designs.

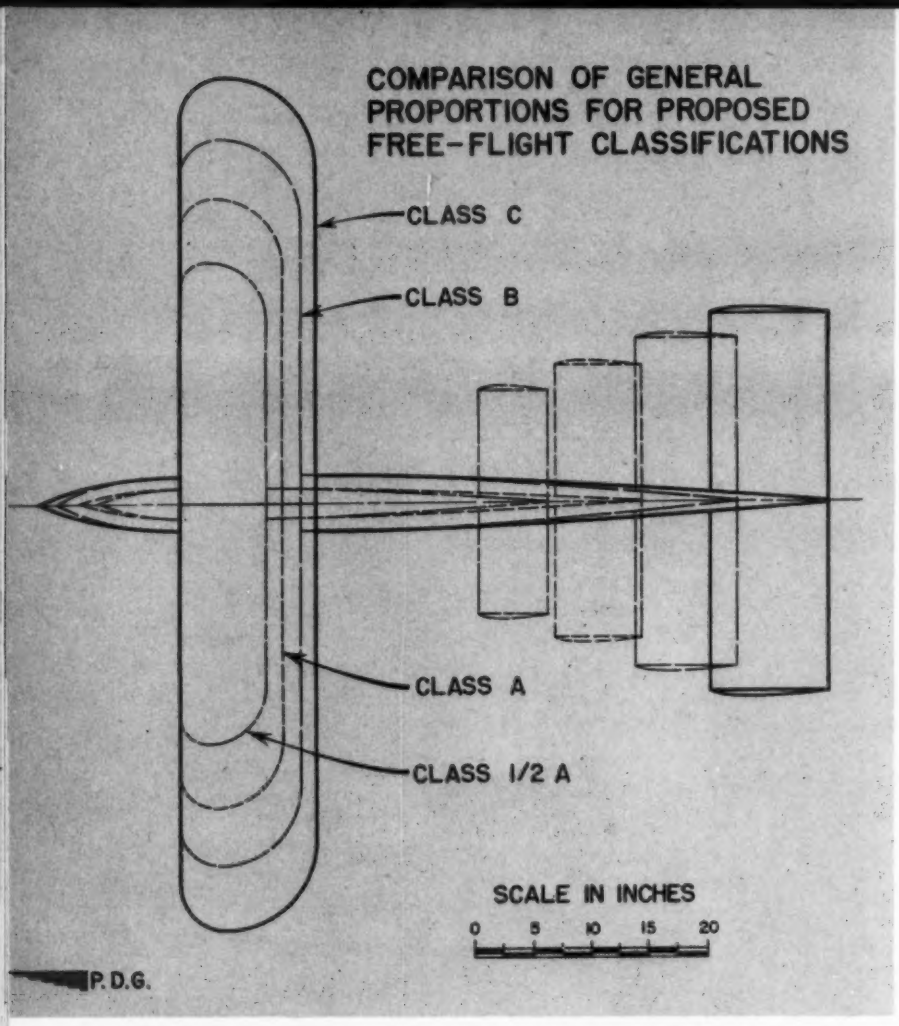
average Joe takes up U-control or drops the hobby. But the flying field is only half the story. What about the airplane?

No one will dispute the fact that a plane's duration must be matched to the size of available flying fields, or that fields now considered too small for contest types could be used successfully by machines with a higher motor run-to-glide time ratio. The present unsatisfactory compromise between performance and field size is a lightly loaded craft, operated with timed, short motor runs, and equipped with dethermalizers to terminate the flight artificially before the plane vanishes from sight or descends among trees or houses downwind.

Long overdue is a model with a new combination of basic factors, such as wing loading, power loading, drag, size, power, and so on, that attains its small field suitability more through its design than through so-called safety devices like the dethermalizer. The beginning point would be the elimination of the pop-up tail or chute for this kind of flying.

If a dethermalizer is required, the model is a contest type; if not, it's a sport job. What this plane will be like no one can say exactly, but there are straws in the wind, such as the Sherman proposals, which begin to fill in the picture. Suggested by Sherman was a well thought out set of specifications for free flight contest models that would control plane power, weight, size, and cabin width. There would be four classes: Half-A—.049 maximum, A—.099 maximum, B—.199 maximum, and C—.299 maximum. Empty weights for these classes would be 10, 20, 40 and 60 oz. Size would be governed by total span (wingspan plus stabilizer span): 60 in. for Half-A, 75 for A, 90 for B, and 105 for C. Minimum interior fuselage width: 2, 2, 4 and 4 in. respectively. Minimum fuselage depth would be 4 in. in all classes. As Sherman sees it, these models should be capable of carrying payload dummies when required by the contest director, not only for the payload event, but when necessary to limit duration to the available flying site. Using 5 oz. dummies, the gross weights would jump to 15, 30, 60, and 90 oz. per class, as shown in the accompanying table.





Above—Comparative sizes and proportions of free flight designs outlined in chart below. Suggested rules were worked out by Dallas Sherman, who developed the PAA-load event idea that became popular.

PROPOSED

MODEL AIRPLANE CLASSIFICATION CHART

"FREE FLIGHT - GAS" CATEGORY

	ALL FREE FLIGHT-GAS MODELS						PAA-LOAD		
CLASS	A	B	C	D	E	F*	G	H	I
	MAX. ENGINE DISPLACEMENT (CUBIC INCHES)	MIN. WEIGHT MODEL EMPTY (OUNCES)	MAX. TOTAL SPAN (S) HORIZONTAL SURFACE (INCHES)	MIN. WIDTH CABIN INTERIOR (INCHES)	MIN. DEPTH CABIN INTERIOR (INCHES)	MIN. DIAMETER (INCHES) MAIN WHEELS, 2 REQD.	MIN. NUMBER DUMMY "OCCUPANTS" REQD. (MIN. WT. 5 OZ. EACH)	MIN. TOTAL WEIGHT PAYLOAD ONLY (OUNCES)	MIN. TOTAL WEIGHT MODEL PLUS PAYLOAD (OUNCES)
1/2 A	0.049	10	60	2	4	1 1/2	1	5	15
A	0.099	20	72	2	4	1 3/4	2	10	30
B	0.199	40	90	4	4	2	4	20	60
C	0.299	60	108	4	4	2 1/4	6	30	90

NO MODELS HAVING MORE THAN 0.29 CUBIC INCH ENGINE DISPLACEMENT TO BE FLOWN IN FREE FLIGHT - GAS COMPETITION

F* NOT APPLICABLE FOR SEAPLANES OR FLOATPLANE

Whether or not Sherman's proposals find serious consideration by the rules makers is not the concern of this article. Our interest is the determination of specifications for a free flight airplane truly suitable for everyday flying by the average modeler. Sherman's specs undoubtedly affect performance in the right direction.

Applied to Half-A (Sherman's free flight without dummy), the total span could be broken down for example) into a 41-in. wing span, and a 19-in. tailspan. Assuming that the individual designer would tend to cram in as much wing area as possible, his only solution would be to increase the chord and hence the area. Therefore, if a 5.5 aspect ratio was employed, the wing area would be 307.5 sq. in. At a 3 to 1 aspect ratio the stabilizer would have a 120 sq. in. area, or about 40 percent of the wing area. The specified minimum weight of 10 oz. results in a wing loading of 4.68 oz. a square foot, as compared with a 2.88 oz. per square foot for a typical 250 sq. in. Half-A, built to a 5 oz. gross. Outside of the fact that a 2 x 4 in. cross section about doubles the usual cross section, it is quite probable that the performance of the "heavied up" theoretical ship would compare favorably with current contest types and, therefore, in Class Half-A, the "Sherman" free flight job probably retains too potent a performance to solve the small field problem.

As a payload model, Sherman's suggested Half-A free flight reveals some interesting possibilities. The gross weight of 15 oz.—five for the dummy—drives wing loading up to 7 oz. if 307.5 sq. in. area is retained. Power loading becomes approximately 306 oz. To the hot free flighter used to hanging the weight of an airplane on the propeller, the latter figure sounds high but, in fact, a plane so powered, and retrimmed for a shallower climb angle, develops surprising speed and fair altitude by flying on its wing, rather than the prop. If we substitute Sherman's Class Half-A payload, a sport model which transforms that dummy pilot weight into structural weight or structural weight plus ballast, what kind of a machine would result? How would it fly? What would be the advantages? The disadvantages?

Given the combination of an .049, approximately 300 sq. in. of wing area, and 15 oz. gross weight, we find that, at a standard 6-to-1 aspect ratio wing, span will be approximately 42 in. and chord 7 in.-a wing area of 294. sq. in. Allowing for 1-in. wing tips, area would reach 300 sq. in. and span 44 in. This is better than 7 oz. wing loading per square foot, and 306 oz. power loading. Since 15 oz. gross is about double ordinary weight for this size ship, the designer can (*Continued on page* 46)

Revell's

New JET FIGHTERS offer All 3 FEATURES

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IT'S BIG 9½"

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VENICE, CALIFORNIA

The new national champion, and junior champ, William M. White, of Sacramento, Calif., receives award from Matty Sullivan, contest director.

1953 nationals

Results of the 22nd Annual "Big" Meet, held at Willow Grove, Naval Air Sta., July 27-August 2.

WHO WON?

National Champ.....William M. White, Jr.
Open.....W. S. Blanchard, Jr.
Senior Champs.....Stuart Savage, Ronald Plotzke
Junior Champ.....William M. White, Jr.
Club Champ.....Northern California Free Flight Council

Scene at the ROW pool was typical of those at numerous events held every day of the week. Approximately 1,000 entrants in calm, wind, sun, rain.

INDOOR

Stick: Open—Merrick S. Andrews, 30:15.5; Sr.—Ronald Plotzke, 18:03.3; Jr.—Robert Petrushka, 4:32.2.

Cabin: Open—James B. Grant, 25:26.6; Sr.—Ronald Plotzke, 13:27.9; Jr.—Harry M. Capper, 0:18.5.

Hand-launched glider: Open—W. Dunwoody, 69.6; Sr.—Charles Corbett, 58.2; Jr.—Dick Culver, 46.5.

GLIDER

Hand-launched glider: Open—Ed Krause, 8:40.1; Sr.—Dave Domizi, 7:14.5; Jr.—Francis Williams, 4:26.5.

Towline, Limited: Open—George Perryman, 12:13; Sr.—Gable Ray, 11:46; Jr.—William M. White, Jr.—6:58.

Towline, Nordic: Open—James A. Pattison, 10:32.9; Sr.—Gable Ray, 9:53.8; Jr.—John Watson, 8:07.4.

RUBBER

Wakefield: Open—Robert L. Hutschek, 14:04; Sr.—James Bowers, Jr.—7:03.6; Jr.—Dick Culver, 6:54.

Limited: Open—Francis K. Heeb, 13:34; Sr.—Thomas H. Alden, 7:05; Jr.—Joseph P. White, 6:44.

FREE FLIGHT

Half-A: Open—Jack Oxley, 13:05; Sr.—Gable Ray, 14:14; Jr.—Bobby Kopski, 13:53.

Class A: Open—Dick Duvendich, 22:08.2; Sr.—Carl Curtis, 12:00; Jr.—Jud Stone, 14:06.2.

Class B: Open—Marvin Burley, Jr., 17:19.4; Sr.—Ronald Wood, 13:35; Jr.—Harry M. Capper, 11:52.

Class C: Open—Alvin E. Grenoble, 17:13; Sr.—David Espen, 14:11.4; Jr.—William Gregory, 4:38.

ROW: Open—Sal Taibi, 13:00.5; Sr.—James W. Kelly, 10:07.2; Jr.—John M. Clapp, 7:02.6.

Half-A Scale: Open—Edward Stoll, 290.22; Sr.—Charles Corbett, 173.52; Jr.—V. Sparnicht, 8.73.

PAYLOAD

Rubber-powered: T. L. Gonzoph, 6:03.6.

Cargo Half-A: Hal Roth—Weight, 23¼; Time, 0:42.

Class AB: Open—Lew Mahieu, 13:56.1; Sr. & Jr. combined—Edward Mahler, 8:06.8.

Half-A: Open—Richard McGrath, 12:59; Sr. & Jr. combined—James W. Bowers, 8:16.2.

CONTROLLINE

Speed Half-A: Open—William Stewart, 84.66; Sr.—Walter Vrablic, 78.22; Jr.—Robert Chojnacki, 74.99.

Speed A: Open—Thomas P. Baker, 130.43; Sr.—Ronald Marchese, 125; Jr.—Walton Pyron, 123.29.

Speed B: Open—Leo R. Holliday, 129.44; Sr.—Herbert L. Davis, 125; Jr.—Walton Pyron, 130.43.

Speed CD: Open—Guy Roger, Jr., 151.70; Sr.—Sam Dehelean, 153.85; Jr.—Alfred Davis, 142.86.

Jet: Open—Norman P. Smith, 141.39; Sr.—Sonny Mosel, 144.46; Jr.—None qualified.

Stunt: Open—R. W. Elliot, 372.5 pts.; Sr.—George Aldrich, 337.75 pts.; Jr.—Walton Pyron, 354 pts.

Flying Scale: Open—Thomas Dean, 170.7 pts.; Sr.—C. Hill Hutchins, Jr., 97.0 pts.; Jr.—Barry Burr, 114.0 pts.

Combat: Open—William Andrews, 520 pts.; Sr.—Gerald F. Wagner, 560 pts.; Jr.—Richard Hurst, 460 pts.

Team Racing: Bob Huffer, 12:1.2.

U. S. NAVY CARRIER

Class A, B, C: Open—Frank Stanton, 379.9; Sr.—Dave Domizi, 391.5; Jr.—William M. White, Jr., 147.8.

Half-A: Open—Gail Eckstein, 253.0; Sr.—William Davies, 240.8; Jr.—Harry Burr, 137.0.

RADIO CONTROL

Jack C. Pert, 121 pts.

HILLER HELICOPTER

Parnell Schoenky, 121.41.

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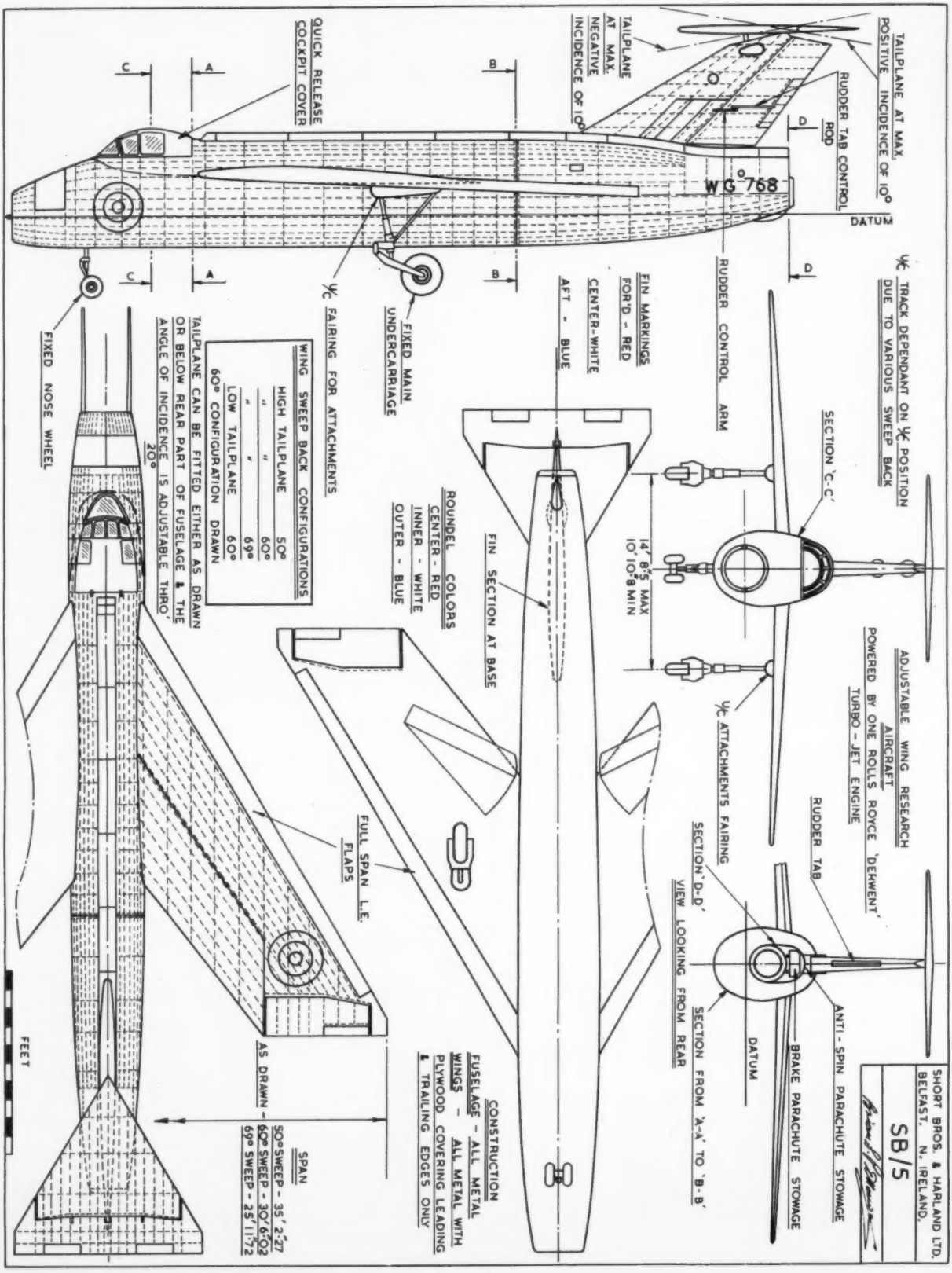
TAILPLANE AT MAX. POSITIVE INCIDENCE OF 10°
TAILPLANE AT MAX. NEGATIVE INCIDENCE OF 10°
RUDDER TAB CONTROL ROD
WG 768
DATUM
QUICK RELEASE COCKPIT COVER
FIXED NOSE WHEEL
FIXED MAIN UNDERCARRIAGE
℄ FAIRING FOR ATTACHMENTS
RUDDER CONTROL ARM
FIN MARKINGS FOR'D - RED CENTER-WHITE AFT - BLUE
ROUNDEL COLORS CENTER - RED INNER - WHITE OUTER - BLUE
℄ TRACK DEPENDANT ON ℄ POSITION DUE TO VARIOUS SWEEP BACK
SECTION 'C-C'
14' 8.5 MAX 10' 10.8 MIN
FIN SECTION AT BASE
℄ ATTACHMENTS FAIRING SECTION 'D-D' VIEW LOOKING FROM REAR
ADJUSTABLE WING RESEARCH AIRCRAFT
POWERED BY ONE ROLLS ROYCE 'DERWENT' TURBO - JET ENGINE
RUDDER TAB
ANTI - SPIN PARACHUTE STOWAGE
BRAKE PARACHUTE STOWAGE
DATUM
SECTION FROM 'A-A' TO 'B-B'
WING SWEEP BACK CONFIGURATIONS
HIGH TAILPLANE 50°
" " 60°
" " 69°
LOW TAILPLANE 60°
60° CONFIGURATION DRAWN
TAILPLANE CAN BE FITTED EITHER AS DRAWN OR BELOW REAR PART OF FUSELAGE & THE ANGLE OF INCIDENCE IS ADJUSTABLE THRO' 20°
FULL SPAN L.E. FLAPS
CONSTRUCTION
FUSELAGE - ALL METAL
WINGS - ALL METAL WITH PLYWOOD COVERING LEADING & TRAILING EDGES ONLY
AS DRAWN
SPAN
50° SWEEP - 35' 2.27
60° SWEEP - 30' 6.02
69° SWEEP - 25' 11.72
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Oils consistently cause engine trouble because of low flash points, formation of acid, gum and sludge when not processed correctly. We find at least one of these troublesome factors in *every fuel* we have tested, *except* our processed fuels. Glance at the laboratory report below:

AVOID RUST AND ACID DESTRUCTION!

In addition to being "ACCLIMATIZED"—with "VOLATANE CONTROL"—FRANCISCO FUELS new, exclusive 4-way processing now *also* reduces aldehyde acid and rust destruction to a minimum . . . characteristics of raw material fuels . . .

Remember, proper processing is necessary normal procedure with *many* materials. Even in *food*, poisonous acids and deterioration can develop if not properly processed. Blindness and death can result if beverage alcohol is not processed to eliminate fusel oil. Why take chances on engine fuel?

Frankly, FRANCISCO FUELS have no competitors — and have won more WORLD'S SPEED RECORDS and FIRST PLACES THAN ALL OTHER PREPARED FUELS COMBINED.

P. S.

Castor Oil is the "king of race engine lubricants" when processed properly. Plain mineral or synthetic oils will not pass our requirements for penetration or toughness. Francisco Castor Oil and Fuels are known as "The World's Finest"!

LABORATORY REPORT

DETRIMENT IN EXHAUST per c UNIT TESTS:	FRANCISCO FUELS	PREPARED RAW FUELS No. 1	No. 2	No. 3
Carbon Dioxide . . .	1.9 lb.	2.8	3.1	3.3
Nitrogen	6.9 lb.	11.7	10.2	9.4
Water Condensed . .	1.21	1.5	1.75	2.15
Residue at 210° F Grams/100 ml: . . .	21.63	24.99	23.68	26.58
Sediment Centrifuge %:	trace	.3	.5	8.0

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Based on 30 years' experience

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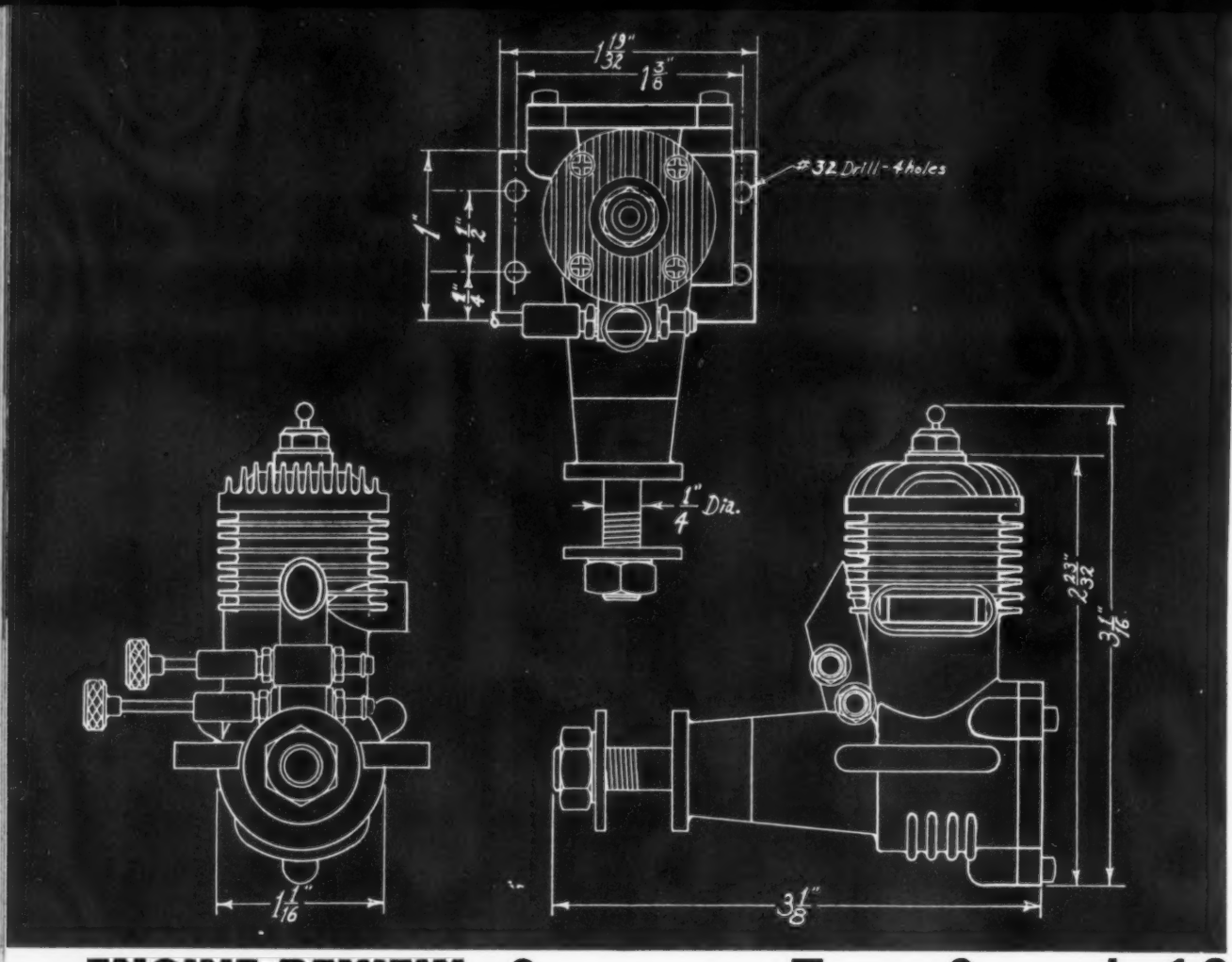


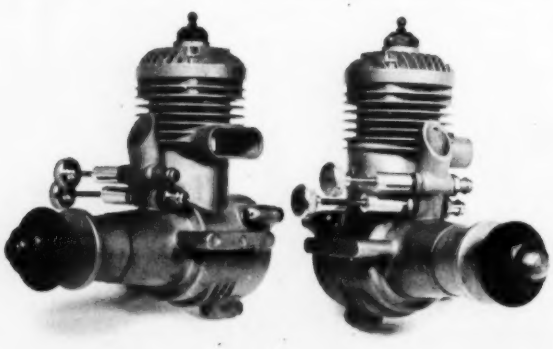
ENGINE REVIEW

Cameron Two-Speed .19

By TED MARTIN

Unusually smooth running distinguishes both the racing and two-speed versions of this beam or radial mounted engine.

Double needle valve system shows to advantage in these pictures. Racing version features light two-ring piston; two-speed, the steel lapped type.



▶ The first things that strike you upon examining the Cameron two-speed .19 are its compact dimensions and good finish. Yet in spite of the small size for displacement, the Cameron embodies some of the strongest and heaviest working parts yet seen on a .19.

The crankcase is a pressure die casting whose quality may be judged from the fact that no subsequent polishing or surface treatment is either employed or necessary. The entire cylinder, intake and main bearing housing are incorporated in this casting, the tapered cooling fins having a particularly clean cut appearance.

An Oilite bronze bushing of 1/16 in. wall thickness is pressed into the very heavy main bearing housing, after which the cylinder bore is machined at right angles to receive the steel liner, thus assuring accuracy.

The virtue of Oilite as a bearing material is that the bronze is sintered from powder form in such a way that it remains porous and therefore absorbs oil. It is claimed that the resulting partial self lubrication produces non-frictional characteristics comparable with those of a ball bearing, and at a considerably lower cost. There is also plenty of evidence that this material provides exceptional bearing life when used in model engines, and with the 3/8 in. diameter shaft employed in this (*Continued on page* 50)

MAN at Work

(*Continued from page 8*)

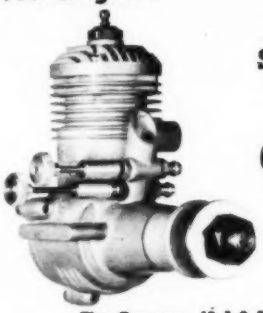
needed in each one. In fact, no less than nine glider contestants scored two-flight maximums. Pete Buskell's free flight power winner was a medium-height pylon of 450 sq. in. wing area (40 per cent stabilizer), powered by a sidemounted Amco 3.5 Diesel. This model featured a geodetic tailplane, weighed 18 oz., and the wing section was undercambered. Second place was also taken by another Amco 3.5 design—of similar proportions.

"Turning to controlline, four British records were broken in speed, the top figure being put up by Ron Davenport's reworked Dooling 61 design (158.7 mph). Something like 40 heats were flown off in the two team racing classes—the most popular motor in "A" being the ED 2.46 Diesel. The stunt entry was disappointing this year and neither of the Hewitt brothers (four times Nats winners) flew in the event. Controlline interest appears to have waned sharply in favor of free flight, although team racing still retains a strong following.

"As is the usual case at British contests, the entries were mostly original designs, the kit type being the exception rather than the rule. Geodetic construction is now no longer a novelty, with many entries in all free flight events featuring this method. Also noticeable in free flight power was the widespread adoption of side-mounted motors and the use of integral fuselage fins. Several free flight entries had clockwork timer operated autorudders to give a straight climb and circling glide, as has long been the procedure with towline gliders. Talking of gliders, this event attracted the top entry of 227." END

CAMERON

.19 engine



2 Speed MODEL

Only $11.95

The Cameron .19 L-2 Speed Engine is designed and built especially for use in radio control and other models where a 2 speed engine is desirable. It can be used the same as any conventional single speed engine and also gives the modeler the added advantage of being able to change the engine speed while the model is in flight.

Manufactured by
CAMERON PRECISION ENGINEERING CO.
Chino, California

NEW "DELUXE MIDGET I" RADIO

STANDARD "MIDGET I" RADIO CONSISTS OF EXAMINATION FREE BAND TRANSMITTING RADIO, (27 M C CRYSTAL CONTROL BAND) A RECEIVER DESIGNED FOR X F G I TUBE OPERATION. THE RECEIVER WEIGHT UNDER 3½ OUNCES, AND A NEW TYPE SOLENOID PRINCIPAL OPERATION, ESCAPEMENT WHICH OPERATES BOTH RUDDER AND ELEVATORS & IS SELF NEUTRALIZING, USING NO SPRINGS NOR RUBBER FOR ITS POWER. MAY ALSO BE USED FOR BOAT OR AUTO CONTROL. OVER 2 YEARS OF ENGINEERING WORK HAVE BEEN PUT INTO ABOVE 3 UNITS. PRICE OF THE STANDARD UNITS INCLUDES A SIGMA 10,000 OHM COIL RELAY, WHICH ALONE IS WELL WORTH THE PRICE WE ASK FOR OUR SET OF PRE-FABRICATED PARTS AND OUR PLANS FOR ALL THREE UNITS. (RECEIVER SHOWN AT LEFT.)

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NOW READY, A NEW "DELUXE MIDGET I", CONSISTS OF THE SAME HIGH POWER LONG RANGE TRANSMITTER AND SOLENOID PRINCIPAL ESCAPEMENT AS EXPLAINED ABOVE. THE RECEIVER IN THIS UNIT HOWEVER HAS BEEN CHANGED TWO WAYS IN ITS CIRCUIT (THE APPEARANCE OF THE RECEIVER HOWEVER IS SAME AS IN PHOTO ABOVE) WHICH GIVES SIMPLIER EASIER RELAY ADJUSTMENT UNDER ALL CONDITIONS. THE SAME 10,000 OHM SIGMA RELAY IS INCLUDED, AND WITH THE NEW COMPONENTS ADDED, OPERATES DEPENDABLY EVEN WHEN BATTERIES BECOME LOW ETC. WITHOUT CONTINUED RE-SETTING OR ADJUSTING. CONDENSERS, RESISTORS, ETC., & ALL PARTS IN GENERAL HAVE BEEN "HAND PICKED" GIVING A LIGHTER WEIGHT UNIT (ABOUT 3 OUNCES). "DELUXE" UNIT ESPECIALLY RECOMMENDED FOR BOAT OPERATION OR FOR EXTENDED LONG FLIGHT WORK WITH AIRCRAFT. OPERATES AUTOS EQUALLY AS WELL. THIS IS AN EXCELLENT BEGINNERS UNIT DUE TO ITS SIMPLIER, EASIER ADJUSTMENT.

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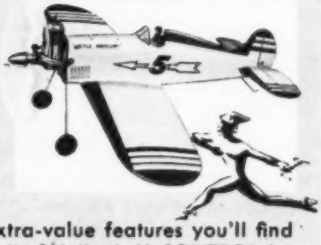

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For the RC Fan

(*Continued from page 5*)

the radio equipment itself is not always to blame. Don't blame the manufacturer of your set or the designer from whose plans you perhaps have built your own equipment. Each of the aforementioned components and items in the general circuit will be taken individually and broken down into an explanation of the DO's and DON'T's and help prevent misfunctioning of your unit.

WIRES: First and foremost in all radio control installations, we must use stranded wire and rosin, or rosin type core solder, in making connections. Solid wire has a tendency to crystallize and break under stresses of vibration. This breakage can occur under the insulation and thus never be detected in time to prevent a crash. The use of ACID CORE solder will eventually corrode wires and components, leading to a possible breakdown at that point; hence, be sure to use rosin core solder. The use of even a soldering paste is frowned upon, as many contain acids. We recommend Ersin 60/40 solder inasmuch as the fluxing action is excellent and this tin/lead combination has the lowest melting point. This is an English solder obtainable at various radio supply stores around the country and in small hanks from Control Research of Hampton, Virginia. Neat wiring not only presents an attractive installation, but properly done prevents wires flopping loosely around, thus changing distributed electrical capacities. The latter can sometimes tend to detune a receiver. Loose wires should be fastened down with small pin staples or tied to a framework member. Transmitter construction should follow the above recommendations also.

BATTERIES: The best electrical equipment will not function if the power supply is faulty. Make your installation to fit readily obtainable sizes of batteries. While certain batteries or cells may seem ideal at the time, if they are unobtainable when you need them, it just isn't good practice to incorporate them in your installation. Use as large a cell or battery as possible in order to obtain longer life. As a battery or cell gets older, whether in use or on the shelf, chemical action increases the internal resistance to the point where, when current is caused to flow, the voltage drops to a lower or unusable level. Therefore, ALWAYS check batteries under the load they will have on them in normal use. For example, a 45 volt battery may read 45 volts when checked by itself but only 40 volts when a current of several milliamperes is being drawn from it. Be sure your battery connections are clean and uncorroded and capable of withstanding the shocks of hard landings. Clean the contacts on your batteries and the battery boxes occasionally with fine sandpaper. Do not allow batteries such as the 22½ or 45 volt packs to joggle or bounce around in the plane or transmitter box as this may lead to a possible broken internal connection. It has happened. Keep batteries away from fuel, moisture and dirt.

RHEOSTATS: Rheostats used for control of plate current or regeneration should be of a good quality and securely mounted in the installation. Do not apply more heat than necessary to make a good clean solder connection, especially on the sub-miniature units. Control Research and Berkeley can supply the sub-miniature types and P. R. Mallory and International Resistance Corp. (handled by most radio stores) make a very suitable midget type for RC work. Do not mount these units where fuel or moisture can get on them. If a rheostat or pot is suspected of being bad, replace it. Do not attempt a repair job if you want reliable performance.

JACKS: When it is desired to obtain meter readings on either the receiver or transmitter,

a unit known as a short circuit, or closed circuit jack, is used. The jack is constructed so that, with no plug inserted, two spring contacts are closed, thus completing a circuit past the jack. The insertion of a plug merely spreads the contacts apart and bypasses the current flow through plug and meter. Usually no malfunctioning will occur in this unit as long as the springs are not deformed by means other than insertion of the plug. The points should be in a protected spot and kept free of grime and dust. Pulling a strip of newspaper or crocus cloth between the points will assure clean contact surfaces. Small units, especially one made by Insuline Corp. of America, can be obtained from local radio supply houses and various concerns handling RC parts.

SWITCHES: Perhaps the component which provides the greatest amount of trouble to the RC builder is the switch, especially in the low voltage circuits (1½-4½ v).

This trouble generally results from picking a switch more for its size than for its electrical characteristics. A toggle type switch is preferred because of its higher contact pressure. Slide switches are satisfactory provided dirt is prevented from entering the open ends. There is little to do in the repair line if a bad switch is suspected (intermittent operation or failure to make or break a circuit) except to change the switch. Switches are readily obtained from radio shops, local hobby shops and even your 5 & 10 cent stores.

ESCAPEMENTS: Last but not least in the installation, besides the receiver, is the escapement. The usual commercial or homemade unit requires 3 to 4½ volts for proper operation. Again, BE SURE to check the batteries under the load of the escapement coil. Often the escapement will skip an impulse as delivered by the relay. This can be caused in general by several things:

Too much tension on the escapement arm—Remedy by fewer turns on the rubber motor or use small rubber;

Too much tension leads to possible skipping by incorrect angle on pawl tips or not enough overhang between the pawl stops and the escapement arms—Remedy by seeing that the overhang is approximately 1/32 in., as shown in Fig. "Y." Also, bend the pawl stop angle so that a fair amount of tension on the escapement arm will not cause the arm to slide past the pawl stop.

The escapement is sometimes accused of "sticking" or "hanging up" in a pulsed position. This can be caused by insufficient clearance between the pawl stop and escapement arm or residual magnetism in the magnet core and pawl. Remedy is to allow approximately .005 to .008 in. (thickness of letter bond paper) clearance between pawl stop and escapement arm in the unlatch position. Residual magnetism can be overcome by inserting a small strip of cellophane from a pack of cigarettes between the pawl and the core. Be sure the rubber motor runs out straight from the escapement shaft since any deviation (running out at an angle) may place a binding action on the shaft and bearings. Very little or no oil should be placed on the escapement since the oil will pick up and hold dust and dirt.

In summing up our first look at sources of trouble, we have the following:

Use stranded wire and rosin core solder for hookup work.

Keep switches, jacks and rheostats free from fuel and other liquids.

Keep the contacts on jacks clean with crocus cloth or newspaper run between them.

Do not attempt to overload the escapement with too much rubber or wind too tightly.

Check all clearances on escapement occasionally and use oil sparingly.

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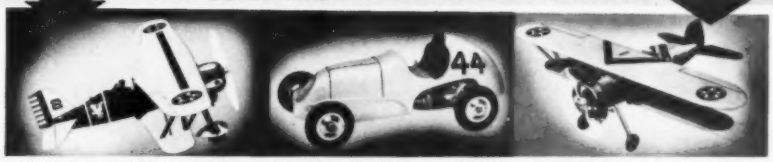

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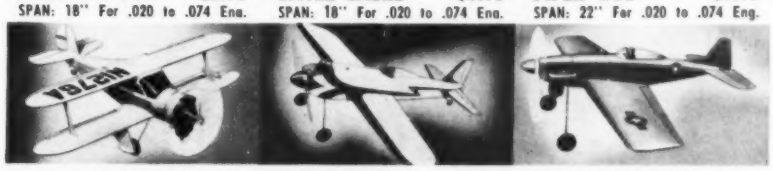

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R/C NEWS

Details and Accessories

Vern C. Macnabb

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However, many other details must be carefully observed to insure successful flying.

Loose connections are one common cause of failure. **CITIZEN-SHIP** Receivers provide Fahnestock Clips for making connections from the set to batteries and actuator. Aside from soldering there is no other connecting means as reliable. Plugs and sockets (excluding military types) should be used with caution and add unnecessary weight.

Another cause of failure are run down batteries. A good meter is needed to know the condition of all batteries, transmitter and receiver, at all times.

The **CITIZEN-SHIP** Test Meter is an especially designed multimeter to read ALL voltages of both receiver and transmitter and is also a milliammeter for checking plate current change and relay settings. **CITIZEN-SHIP** Test Meter is a MUST for successful RC flying. It accurately shows the following readings:

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CITIZEN—SHIP RADIO CORP.

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Next month we will cover the receiver and relay problems, and follow with information on the transmitter.

NEW ITEMS

This month we present two new small electric motors, both of which are distributed by Polk's Model Craft Hobbies, Inc., of New York City.

The first is a 2 oz. unit with ball bearings at both ends of the 3/32 in. diameter shaft, a unique thing in itself in the toy motor field. The very well designed plastic case measures 1 1/16 x 1 5/16 x 2 1/16 in. and features removable armature and carbon composition brushes. The no-load current drain at 1 1/2 volts is 200 mils and 300 mils at 3 volts. Price is $5.95.

The second motor weighs 1 3/8 oz. and measures 7/8 x 1 x 1 1/8 in. The shaft has 3/32 in diameter and extends from both ends of the case. The construction is of stampings plus a high powered alnico magnet. This motor develops exceptional power and speed for its size. The no-load current drain at 1 1/2 volts is 300 mils and at 3 volts the current drain is 400 mils. Price is $1.50.

As with all motors of this type (permanent magnet field) the current drain increases as the load on the shaft increases.

In the line of new receivers, Electronic Developments, distributed by Polk's, have a new three sub-miniature tube, modulated carrier receiver. The bare receiver weight is about 4 oz. and measures 1 1/2 x 3 5/8 x 4 1/8 in. This receiver has won wide acclaim in England and on the continent and the plaudits of several RC fliers who have been test flying it in this country for the past few months. Easily obtained sub-miniature tubes, extreme sensitivity, freedom from the usual run of interference and a polarized relay are features of this receiver. The transmitter is a modulated unit similar to the regular ED/Aristrol transmitter.

(In the June, 1953 issue was presented an article, Pulse Sequence Control, which was by-lined by John Worth. John informs us that MAN overlooked the credit to Don Hewes, who should be credited for the control system described.—Editor)

Watch the birdie

(Continued from page 16)

air molecules are traveling at highest velocity. Toward the trailing edge pressure increases as air molecules are slowed down. To fight the increase of pressure a considerable amount of energy is necessary. The laminar boundary layer soon spends all its kinetic energy and eventually is forced off the surface in large vortices, forming rythmically (Fig. 5). Lift is destroyed while drag increases simultaneously. The wing stalls out. Increasing the angle of attack speeds the formation of vortices.

If the flow is turbulent, the minute vortices formed in the boundary layer can absorb energy from neighboring layers and succeed much better in battling the increasing pressure toward the trailing edge. It stays close to the surface of the section and detaching vortices do not form until a very high angle of attack is attained (Fig. 6).

The preceding paragraphs show that no matter which foil is used, it is most important to keep the boundary layer turbulent, in order to have an efficient lift/drag ratio. Many foils highly efficient in full-size craft cannot be used for model purposes because their configuration does not permit the boundary layer to become turbulent at the model's low RN. In particular, very thick and round-nosed foils which provide generous lift at high RN fail completely in model wings. The author built a rubber-powered test model several years ago which was fitted with the very thick GO-382 foil. Under power the model climbed steeply and fast.

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As soon as the power gave out and the prop stopped rotating the model stalled out and went into a straight dive from which it did not recover. Repeated flights with different trims showed similar results. As expected, the thick foil caused laminar flow which was made turbulent by the vortices detaching from the rotating propeller. When this artificial turbulence failed, the boundary layer turned laminar again and the wing stalled out. Even the high speed of a straight dive was not sufficient to let turbulence reappear.

Some years ago, Dr. F. W. Schmitz, a German aerodynamicist, launched into extensive research on low RN airflow. He employed the specially rebuilt wind tunnel at Cologne, Germany. Realizing that the high turbulence factors of standard and high pressure tunnels would prevent correct determination of the transit point from laminar to turbulent flow at low RN, he added long stretches of dampening devices to the tunnel to bring its turbulence factor down to where, for practical purposes, it could be disregarded. His findings show that cross sections for models must get thinner as RN decreases. Also, leading edge radii must be kept small. Fig. 7 is a reprint of foil data suggested by Schmitz.

As high as the ratings of foils wthin the limits of Dr. Schmitz's suggestions may be, they have one drawback: they are thin, and larger built-up wings employing them will be weak and prone to warp.

The similarity of wing loading and RN between model plane and bird wings prompted several inquisitive minds to check on the cross sections of bird wings. The results were rather startling. Birds with best soaring abilities and smallest angle of glide featured cross sections that, though constant in their own breed, differed greatly from the cross sections of all other bird species.

The wing's flexing muscle protrudes in the form of a thin ridge in front of bones

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and the heavy, stretching muscles. Thus a step is formed, leaving a thick section with a sharp leading edge. This foil can be found in the wings of vultures, kites, storks, cranes, and flamingoes.

The Yugoslav modeler Seredinsky developed a model foil, shaped after the more rounded cross section of flamingo wings (Fig. 8). While it features an extremely flat glide, the author's experience with this foil showed that it is rather fast and, consequently, requires a somewhat heavy wing loading.

Further investigation along this line of foil development led to the design of the FH 100 T foil. A Jetex 350 powered model was designed around it which had a wing span of 38 in., an average chord of a little more than 5 in. and weighed 12 1/2 ozs. Jet power was chosen because all possibilities of induced turbulence were to be excluded. Flight tests showed an out-of-this-world glide after a fairly flat but fast climb.

The FH104T foil represents another step forward.

Austrian modelers, also investigating the possibilities of bird foils, had found that a long, tapered trailing edge, too, provided a better lift/drag ratio. It was felt that investigation of a combination of both approaches should provide valuable information. FH 104 T is one of the results and, as far as the state of affairs has progressed at this writing, it seems that there are no disappointments ahead. More information will be available after completion of a hydrodynamic flow tester, now under construction.

Schmitz also evolved methods of changing laminar flow on standard foils into turbulent boundary layers. He succeeded so well that the critical RN for the GO-625 foil (Fig. 9) was lowered from 105,000 to 20,000. To effect transit from laminar to turbulent flow following methods were tested:

A. Pointed leading edge; B. Rough upper surface on nose section; C. Turbulence wire; D. Sonic vibrations (high pointed whistle).

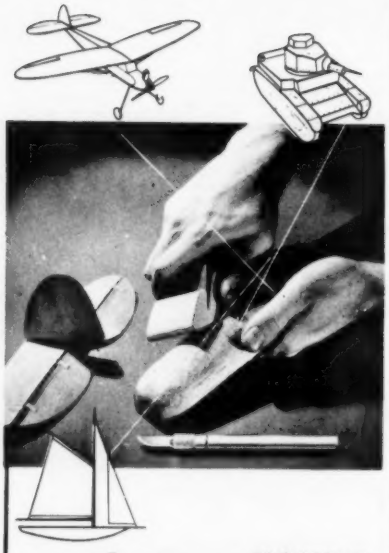
Of these methods the last one proved impractical. The best results were obtained from the wire which was placed 10 per cent chord ahead of the foil and approximately level with the point of pressure at 0° angle of attack (Fig. 9). Very thin stranded wire or heavy sewing thread is recommended.

Rough nose sections were obtained by planking the upper surface between leading edge and main spar at about 30 per cent chord with coarse sandpaper. This method works satisfactorily on some foils. So does the sharp leading edge.

Some time ago, modelers were beginning to experiment with laminar-flow foils designed for jet craft. In the light of everything said so far, this may seem to be a mistake. But considering that laminar flow is more easily attained in models than a turbulent layer, a promising field of investigation is opened.

After the Russians lowered the Iron Curtain, resistance groups in western Germany occasionally employed tow-line model gliders loaded with leaflets and pamphlets to spread truth in Russian occupied territory. One of the designers accidentally had come across some laminar foil data and fitted his first practical payloader with wings of laminar flow section. Even though the total drag of the little craft was high because of the necessary large fuselage cross section, its weight lifting and gliding properties were so good that after the first model of this type had been launched, all other designs were refitted with laminar flow wings.

Fans of PAA-Load events should be warned, though, that turbulence from prop wash will destroy the lifting qualities of laminar flow foils. Also, the construction of laminar flow wings is difficult, as their surfaces have to be extremely smooth to prevent formation of boundary turbulence. END



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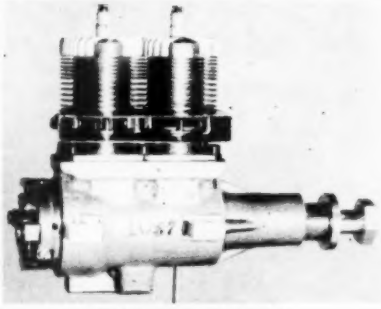

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Transistors

(*Continued from page* 19)

alternate n-p-n and p-n-p transistors with no resistors or condensers are being made. The output of one transistor is simply connected to the input of the next. For a tone operated RC receiver such a circuit should be ideal.

We do however have some precautions—transistors should not be subjected to extreme heat. While some units are manufactured with leads of such length that they may be soldered directly into the circuit, it is recommended that at least 1/2 in. of lead be allowed to remain and the heat be dissipated rapidly by holding the lead with a pair of long nose pliers during the soldering operation. Also, the transistor should not be removed from the socket while power is "on" as sudden "surge" currents may cause temporary or permanent damage.

Searching for an immediate application of the transistor to an RC circuit, the logical choice seemed to be the use of the transistor as a DC amplifier following the output of a RK-61 receiver. While this circuit offers no increase in battery economy, the RK-61 may be operated at a much lower value of plate current and therefore its useful life increased many, many times. This thinking, a 52 mc Aerotrol receiver (The 27 mc receiver will work just as well), and a little work produced the receiver shown in Fig. 1. Two receivers have been made and both seem to perform equally well.

The CK-722, when used in the circuit shown in Fig. 1, will exhibit a current gain of approximately 10. Thus when R2 is adjusted so that the idling current for the RK-61 is 0.4 ma, the collector current for the CK-722 is 4.4 ma. Upon receipt of a signal the RK-61 plate current drops to 0.1 ma and the CK-722 collector current goes down to 1.4 ma. The collector current change is sufffciently wide that reliable relay operation is insured.

Some provision must be made to remove the collector voltage from the transistor when the receiver is not in use. A switch may be wired in series with J-2 or the shorting plug may be removed from the jack.

The 22 1/2 volt tap was obtained by opening the bottom of the 45V "B" battery (Everready No. 455) and connecting a Fahenstock clip with a short length of wire to the junction of the two 22 1/2 volt sections.

Maximum base current for the CK-722 is 0.5 ma. It is therefore important that the adjustment of R-2 be maintained so that at no time does the idling current of the RK-61 (which is the base current of the CK-722) exceed this value. Considering that the maximum collector current for the CK-722 is 5 ma, no more than 22 1/2 volts should be applied to the collector and the relay resistance must be 5,000 ohms or higher.

Obviously, any RC receiver may be connected to the input of the transistor and perform comparably to the one shown, provided it operates reliably with an idling plate current of less than 0.5 ma.

Another transistor circuit is shown in Fig. 2. It is suitable for detecting a change in the pulse rate of a proportional control system and operating a second control such as engine speed. Similar circuits using vacuum tubes have been used by several RC enthusiasts in the past (MAN, April, 1953). However, this circuit eliminates the need for filament batteries and permits the use of a smaller "B" battery.

In some cases more economical battery operation may be realized by addition of a resistance in series with the relay, therefore decreasing the idling current of the transistor. As in the case of the receiver, the proper adjustment of R-2 will hold the base current below 0.5 ma.

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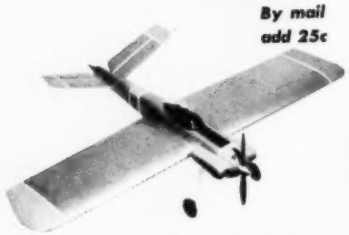

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parallel with the rudder actuator, control pulses are induced into the secondary of T-1, these to be rectified by the crystal and applied to C-1 as a charging current. The discharge current of this capacitor is used as a bias current for the transistor. Increasing the pulse rate will result in C-1 being charged more frequently and therefore the average bias current for the transistor increases, producing a decrease in the collector current passing through RY-1.

Small Field Models

(Continued from page 32)

put more into structure, using heavier members, more closely spaced ribs, and any desirable realistic touches, such as wheel pants and fully cowled motors. Ounces can be expended on finish and color schemes. Some may inquire, *"Will* it fly?" and not *how* it will fly. That it will fly is attested by the deBolt Model Engineering Co. Half-A Kitten for RC, which has creditable performance.

To help visualize this mythical sport plane, let's first compare the proposed payload figures, and their resulting loadings, with existing models which more or less have common specifications. A type which conveniently fixes for us the maximum load which an .049 can sustain for 40 seconds on a 20 second motor run is the Cargo Clipper. At a gross load of 21 oz.—five for the plane and 16 for the cargo—the CC type has a power loading of 428.5 oz. If the CC ship was permitted an engine run of 40 or 50 seconds, it certainly would reach the limits of a fair sized field. It would be agreed, however, that its performance is too marginal for even the most conservative sport flier. The Clipper does have a huge wing, hence lots of drag. One of Frank Ehling's designs had a 345 sq. in. wing and, at an assumed 21 oz. gross, a wing loading of 8.76 oz.

Comparison of the Cargo Clipper with the mythical sport brings out that the Clipper has a somewhat higher wing loading, a vastly higher power loading and, probably, moderately higher drag. The Sport, therefore, having less drag, lower power loading, and somewhat less all-up weight and wing loading, can be expected to take off unassisted and to climb well enough to insure successful flights that should remain on the field. The motor run can be increased where practical.

One of the most interesting and successful sport ships of recent years is the Veco Dakota, a small, all wood cabin-type biplane, of sturdy U-control type prefabricated construction. Power is anything from an .02 to an .074, span is 24 in., wing area (both wings) 161 sq. in., and weight 5 to 7½ oz. The Dakota is ingeniously designed with extreme left thrust and flies in an identical, left hand, tightly banked circle on every flight with low power. With an .02 Infant, for example, it will maintain altitude from a hand launch and perhaps gain height slowly. At 5 oz. gross, this is a power loading of 250 oz.; an .035 gives 114-oz. power loading, and an .065, 78.4 oz. power loading. At 7 1/2 oz. gross these figures would be 375, 211, and 115 respectively. In this case the Infant job might not fly but with the Royal Baby, climb would rocket and catch all eyes on the field. The tight, steep glide precludes thermal susceptibility and eliminates dethermalizer worries. This is spectacular performance with a vengeance, without the plane leaving the confines of the field.

Wing loading on the Dakota at 7.5 oz. gross is 6.7, rather high for so small an airplane, where scale effect causes a glide comparable to that of bigger jobs with more than double the loading. Allowing for the fact that the machine is a bipe, the equivalent monoplane area would be but 135 sq. in. and wing loading is closer to 8 1/2 oz.

From these figures and demonstrated per-

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formance, the Dakota evidently would have reasonably exciting performance under power with an .049 and could successfully be confined to very small fields, suiting the engine run to the wind conditions. The most useful conclusion is that wing loading primarily influences duration; and that with a sufficiently high power loading for the flying field area involved, the rate of climb and hence the time it takes from engine cut-off back to earth may accurately be controlled by selection of a power plant. This principle may be applied with excellent results to aircraft of varying sizes.

Radioless Live Wires are appearing in the guise of sport ships. Span of this boxy little job is 48 in. and area 432 sq. in. With radio these ships have been flown well at all weights from 35 up to 50 and the writer saw one perform with a 65 oz. gross with two-channel radio and an ED 2.46 engine. Wing loading at 35 oz. is nearly 12 oz., giving a reasonable glide; without radio the wing loading drops to 10 oz. and less. A 25-oz. Live Wire, less the radio, will fly with an .049 and would perform creditably on an .065 or .074. Normally, with its indicated .09 engine, the Live Wire has a minimum power loading of 389 oz. and can be gotten up some hundreds of feet on a long motor run. It is evident that the combination of an .09 with a gross weight of 30 oz. (no radio), will give realistic climb, and a glide which probably could be held within the field, but which might snag a thermal if allowed to climb too high. So, for a 4-ft. airplane we have another workable figure, a "sluggish limit" of about 335, let's say 325 oz., power loading and a 10-oz. wing loading.

One of the more daring cases of low power loadings was the Elbert Weathers Pacificoaster, a 5-ft. span free flight of most realistic appearance, powered by an Orwick .64. Wing loading was phenomenally high at 18 oz., the result of 5 sq. ft. of area and a 90-oz. gross. What seems like an impossible-to-handle engine displacement figures to 140 oz. power loading, which is a trifle on the underpowered side by hot contest model standards. Any debate as to whether such a plane would fly well is beside the point. The Pacificoaster proved the point.

Bill Seidler, an eastern speed flier, appeared with a Pacificoaster for RC, equipped with a Macnabb unit and an Atwood Triumph. It should have been a tricky flier because of excess power. An extra foot of span had been added, and the gross weight was 9 1/2 lb. Wing loading was over 25 oz. a square foot and power loading 298 oz. per cubic inch of engine displacement. Although this plane would achieve altitude to spare on a long run, such a gross would not yield gratifying performance on short runs of, say, 20 to 30 seconds and, therefore, the figures would be considered as an extreme limit for a sport type plane for large engines. Unfortunately, a plane this size would be no solution to the field problem regardless of its performance.

An accurate appraisal of sport model performance in the larger sizes can be made from the Class AB payload jobs and such radio kits as the Berkeley Brigadier, Bootstraps, and deBolt's Senior Live Wire. It will be noted that radio and payload loading are so nearly interchangeable that the dual purpose kits have been successful—again, the Brigadier. But when such transitions are made it has been found that in the interest of controllable climb and smooth response without flyaways (despite operative radio), it is generally desirable to restrict power on the radio version. After all, the payload model is intended for maximum climb and duration with load, whereas the RC strives to eliminate all but the marginal climb and duration in the power-plus-glide sense is meaningless. Many

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prominent fliers confirm this. Ray Matthews, for example, relates that his payload would bank and hold altitude when the rudder was operated by radio, but it would climb to dangerous altitudes when the radio was neutralized. In a wind such a plane probably would be lost.

All this suggests the unsuitability of the payload airplane, or the radio plane when given equivalent power to a PAA load, as a yardstick for a free flying sport machine. Unless, of course, the gross weight was very great. Either weight must be added, or power reduced, or both. In view of the already excessive size of the AB payload plane as a sport ship, it would appear desirable to limit power by equipping the equivalent sport jobs with a weak .19 in lieu of the .29, or a .14 or .15 in place of the .19, and throwing the dummy weight into heavier and sturdier structure.

In what will be the more popular size, the .049 job, numerous working examples already exist. Louis Culler had the standout flying scale of the 1952 Nationals, a Piper Super Cruiser from a Berkeley kit, using an .049 engine. This first cousin to a sport model has 170 sq. in. of area—supposedly small for a controllable scale job—and a gross weight according to the manufacturer of about 7 oz. Now designers will tell you that this small area should result in an erratic flying scale job, but Culler's was among the most stable seen. How come? Those loadings figure to about 143 oz. for power and about 6 oz. for the wing.

Since Culler's job had rather peppy performance for a small scale and since expert adjusting might figure in the deal, it would seem safe to assume that these figures represent the smallest and highest power machine for scale or sport that would give reliable performance for the average flier. The real limits actually are hair raising when one considers Stolzenberger's Swoose (MAN, Oct., 1946), which combined Infant area with an Arden .09! It flew most successfully. Its wing loading, however, was 16 oz., extremely high for so small a ship where scale effect magnifies the effects of loading increases. In other words, weight was used to bring within reason the performance that would result from an engine as powerful as the .09.

From all these considerations we know, first, that a suitable free flight must be based on a small engine, and the smaller the flying site the smaller the engine; secondly, that performance must be controllable by means of wing loading, power loading, and drag. The combinations are infinite. Since some must be better than others, let's sift a few possibilities.

High power loading (low power relative to the weight of the machine), but low wing loading; high drag, relative to the power available, not necessarily a high lift drag ratio for the entire machine), in other words, a floater with a small engine. Dick Querman, has an Atwood .049 low pylon type with better than 400 sq. in. of area. On a contest motor run it will gain perhaps 100 ft. of altitude but its glide can keep it in the air for several minutes and it is highly sensitive to the slighest riser. Good for contest work under some conditions, it is an interesting approach, but it would hardly make a sport job.

At the other extreme, that is, very high wing loading but low power loading—a heavy, high powered machine—the Dakota is a workable example. Though it is a good design that is fun to fly, many people can be expected to prefer a longer glide, if only to look at.

Where, between these extremes, would lie good all round figures for the sport plane? The Sherman proposals do lie between the high power loading-low wing loading combination and the low power high wing loading

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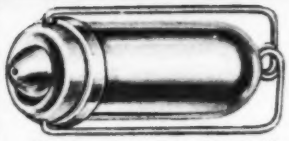

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set-up. It would be difficult to pin-point a combination ideally suited to every free flighter but Dallas' proposed rules provide a further spread in that he gives, for each displacement, a variation of power and wing loadings by means of payload. Thus, we might regard the mythical Sherman model without payload as our higher performance limit and with payload (but putting the payload into structure) as the lower performance limit. Modelers who have sufficiently large flying areas for bigger engines can figure out appropriate airplanes from his table. But for near-city flying, two classes sound reasonable: the .049 and .09. By averaging out Sherman's payloadless jobs and the payloaded ships for these displacements, some excellent possibilities result.

Engine Displacement	*Minimum Weight*
.049	10 oz.
.09	20 oz.
Maximum Weight	*Average Weight*
15 oz.	12.5 oz.
30 oz.	25 oz.

We already calculated the Sherman .049 job to have a typical span of 41 in., and a stabilizer of 19 in. With a 5.5 aspect ratio wing (the largest demonstrable safe chord giving maximum area for the span), area was 307.5 and wing loading 4.68 oz. without payload, 7 oz. with payload. The averaged out .049 sport might have a wing loading of 5-3/4 oz.—let's say six for a round number. This plane is shown in the illustrations.

From Sherman's table, a total span (wing and stab) of 75 in. is suggested. If it could be assumed that sport models would never be flown at contests, there would be no point in bothering with limitations or rules, such as the total span idea. However, sport jobs may some day compete in their own events, or clubs may even now wish to schedule such events, so some kind of rules are necessary. Rules being necessary, Sherman's proposed rules provide a workable yardstick for estimating sport jobs, whether or not they are flown in contests. So, if the 75 figure is broken down into 52 for the wing and 23 for the stab, a 9-in. chord would give an aspect ratio of 5.8 and a wing area of 468 sq. in. A 5-in. chord stabilizer would give a tail area of 115 sq. in., or approximately 25 per cent of the wing area. The resulting wing and power loadings would then be about 7.6 and 277 oz. respectively.

When one considers a 25 oz. airplane for a 52 in. wingspan—the author's Acrobat RC at 56 in. weighs 59 oz. with a .14 on an .09, a pretty fair idea of performance can be had. If it is trimmed to fly at a fairly flat climb angle, its performance will be surprisingly high. Of course, if the model is hung on its prop à la high-powered, lightly loaded pylon contest type, a mushing power flight with low duration will result. But despite reasonable performance, 25 oz. is a lot more weight than a free flight designer is accustomed to. It means that a virtually crack-up proof construction may be utilized.

One-eighth sheet or longerons at least 3/16 in. sq. may be used. Wing spars may be as heavy as 1/4 x 1/2 and leading and trailing edges 3/8 sq. and 1/4 x 1-1/4 triangle stock respectively. Ribs would be cut from 3/32 in. sheet and closely spaced to maintain a good airfoil between ribs. Nose construction should largely be blocks. Enclosed cowls, applecheek cowls, wheel pants—no penalty.

For clean cut performance at these higher loading figures it is suggested that longer nose lengths, short tail moment arms (but watch the latter when a wide chord is used!), and a more forward CG be employed.

If you have flying field problems and a hankering to make a couple of dozen flights in a day without losing the plane, these sport jobs are for you. END

—WILLIAM WINTER

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Cameron Two-Speed .19

(Continued from page 38)

instance, a very long working life may be expected.

Full advantage is taken of the large diameter shaft by utilizing a 9/32 in. diameter gas passage to the shaft rotary inlet port which is situated as close to the crankweb as possible without encouraging excessive leakage.

An unusual feature is the method of locating the prop driver by mounting it onto the full 3/8 in. dia. portion of crankshaft which projects 5/16 in. beyond the bushing, thus insuring concentricity. The drive is then conveyed by mating tapers at the point where the shaft diameter is reduced to 1/4 in. and threaded for a blued steel 1/4 in. standard hexagon nut. A steel thrust washer is provided between the bearing housing face and the prop driver.

Counterbalancing of the shaft is accomplished by milling the web on either side of the crankpin, which, in view of the substantial thickness, is unlikely to cause weakness, and has the important advantage of eliminating the extra crankpin overhang common with other types of counterbalancing.

The crankpin is solid, though of small diameter, and boasts an exceptionally fine finish, as does the shaft itself. This is apparently produced by superfinishing after heat treatment and grinding.

An aluminum alloy forms the basis of the conrod. The shank is relieved for crankweb and backplate clearance, and the bearings apparently broached to a very high finish and excellent fit on both crankpin and wristpin. The life of these bearings should also be unusually good. A beautiful surface finish also distinguishes the 3/16 in. dia. tubular wristpin, which is the fully floating type with brass end pads for cylinder wall protection.

The racing version of this engine features a light alloy piston with two rings, but in the two-speed Cameron, a hardened steel lapped type is used, being better suited for low speed operation. In keeping with the rest of the engine, the machining of this component is first class, the high baffle being slightly curved to improve gas flow and reduce charge loss. The top 1/4 in. of the skirt is mated to the cylinder, with the lower portion slightly relieved to minimize oil drag.

A unique feature of Cameron design is the cylinder liner location. Machined from high grade cast iron or Meehanite, and ground both inside and outside, the liner does not have the customary flange for vertical location, but instead, the lower edge seats on a lip, machined at the bottom of the cylinder barrel portion of the crankcase casting. The head, bearing down on the upper edge, with a gasket in between, thus sandwiches the liner in such a manner that longitudinal expansion has the minimum effect on port timing, and any differential expansion is absorbed by the gasket without imposing undue strain on the liner.

Having a full 1/16 in. wall thickness, this drop-in type liner should be unaffected by distorting influence, but nevertheless, to facilitate disassembly, a slip fit is used between liner and casting, and in order to insure positive port alinement, a shallow keyway is milled in the lower portion of the periphery, which engages over a locating pin in the crankcase. It is therefore impossible to assemble this component incorrectly, and last but not least, a most excellent fit and finish have been achieved on both piston and liner, and the bore into which the latter fits.

Although the exhaust stack appearance suggests small cylinder ports, they are actually close to the maximum possible in length, and slightly above average in opening period, but without any of the poor torque and starting qualities often associated with big ports. The bypass passage has a fairly large cross-sectional area, and is machined to a smooth uniform finish with a curved and accurately alined entry to the bypass port.

At top dead center, the piston baffle stands clear of the top of the liner and casting, and

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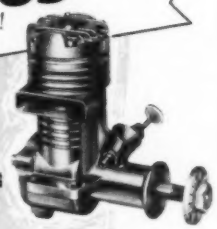

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the die cast aluminum head is therefore recessed to provide clearance and an efficiently contoured combustion chamber, with four Philips head bolts to complete the assembly.

A conventional die cast aluminum crankcase backplate is retained by bolts screwing into three sturdy crankcase lugs, which, by the substitution of longer bolts, could be used for radial mounting. A paper gasket seals the joint.

The carburetor intake is unusually long and extends almost to the top of the cylinder, with obvious cowling advantages. Design of both spraybars is identical, and they are reversible and interchangeable. The needles, however, are of unequal length in order to avoid mutual obstruction when mounted on the same side, and each is fitted with a nicely finished knurled aluminum control knob, and a split sleeve friction device.

The upper spraybar is slightly forward of the center line of the intake, whereas the lower spraybar is central. The makers, however, recommend that the jet hole be positioned at an angle of 45° to the horizontal in both cases, rather than in the normal underside position.

A point of particular importance to the successful operation of a two-speed engine of this type is correct plug selection, and the use of fairly hot plugs will promote smooth running on the low speed jet, and minimize the tendency to stall when changing down.

On test it was found that the lower jet gave the most satisfactory low speed performance, and with a 9 x 6 prop and the plug supplied, a steady idle could be achieved at about 3,500 rpm. However, for reliability, 4,500 is the working minimum, with changeover both fast and positive. Both needles gave smooth and progressive response to adjustment and held their settings.

The engine is remarkably free from vibration at all speeds, whether beam or radial mounted, and there was a complete absence of power loss as operating temperature was reached, which is undoubtedly attributable to the cylinder design.

Test: Cameron Two-Speed .19

Plug: O & R Racing Long Reach, 1 1/2 volts to start; Fuel: Supersonic 1000; Running time prior to test: 1 1/2 hours; Bore: .620 in.; Stroke: .625 in.; Weight: 4 1/4 ozs.

Power Prop	*RPM*
10 x 6	11,000
9 x 6	11,500
7 x 10 1/2	12,400
7 x 9	13,200
7 x 8	13,600
Top Flite	
10 x 6	10,500
9 x 6	11,100
9 x 8	10,600
8 x 8	11,150
8 x 6	11,500

Those FAI Gassies

(*Continued from page* 12)

recommendation to use smaller models with glow motors for comparable climb.

Despite the near successes achieved with shoulder-wing designs in Europe, and particularly Continental Europe, the pylon layout is still, undoubtedly, the best approach to gas duration design. In this respect, too, who knows better than American modelers how to design and produce pylon gassies? Pylon models continue to hold top honors in Europe and American influence is pretty obvious in these designs. Some more unorthodox trends are shown in the photos.

Design development might well be expended on improved structures rather than attempting to modify the almost "standard" pylon. Consistency is likely to pay better dividends than the comparatively slight ben-

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efits of improved aerodynamic efficiency. Also, timing the engine run is another very important factor. Attention to practical details wins more competitions than applied aerodynamics. An engine run short of a permitted maximum by two or three seconds can make more difference to the flight time than the drag saved by turning a blunt wing tip into a nice elliptic shape. Many Austrian models, for example, designed on aerodynamic lines, are weak in the practical sense.

The most vital structural components are, in order, the fin, stabilizer, and wing. That order represents their degree of sensitivity. It seems absolutely essential that the first two, at least, should be definitely anti-warp structures, and the wing preferably of the same kind also. Sheet construction generally solves the fin problem, with geodetic ribs a "must" if built up. Geodetic or warren-girder rib arrangement is highly desirable for the wing and stabilizer on even the smallest gas models. The former is gaining increasing popularity in Europe. The weight penalty is very small and the resulting structures much more rigid.

Otherwise, a '54 World Championship Gas design follows very much the lines of any model produced for the present AMA contests, limited within two size ranges according to the displacement of the engine chosen and with slightly modified wing and power loadings, as compared with present AMA standards. Of the present participants in the FAI World Championship Gas events—and there have only been two such contests so far—no one country has established any marked superiority. For comparative purposes, a summary of some of the more interesting designs is given in the main table, together with "standard" designs proportioned around the pylon layout according to the details discussed. In the end, however, it is generally the man behind the model who counts—not just the design. END

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BEAVER: Control line model for .19-.29's. Feb. '52.

ZENITH: Taibi Class A '51 Nats cabin job. Feb. '52

Spooky

(Continued from page 14)

medium hard quarter-grained sheet balsa. Notice that slots for lead-out wires are cut only in seven of the ribs to be used in the left wing wing panel, since the model will be flown counterclockwise.

After the ribs are cut out, they should be stacked and pinned together and then sanded very carefully with a SANDING BLOCK. This will insure uniform accuracy and will make the assembly job much easier.

Medium hard 1/8 x 3/4 in. tapered trailing edge stock should be selected for straightness, then laid over the wing layout on the drawings and the rib position accurately marked with a pencil. 1/8 in. wide x 1/8 in. deep notches are cut at each position and checked for a smooth sliding fit by actually slipping a rib in each notch. Touch up each notch with the file to make each rib fit just right. Too tight a fit will make the wing warp hopelessly and too loose a fit will result in a very flimsy structure.

Trace the tip outlines directly from the plans on 3/32 in. medium hard sheet and cut to size.

Select a piece of 1/4 in. square medium hard balsa strip, carefully avoiding warps and twists, for the leading edge.

A wing of this type is most easily assembled in a vertical position, and not by laying it over the plans, as is commonly done with wings using lifting airfoils. We assembled the original wing by first standing the trailing edge with the notches facing up and holding it in this position with scrap balsa blocks pinned to it and the workbench. Starting at one tip we started gluing the ribs in the notches, checking each rib for squareness with respect to the trailing edge and sighting along the ribs from one end to insure proper alinement. The ribs should be pinned in place as they are alined to insure accuracy while the glue is drying.

As soon as all the ribs are cemented to the trailing edge, a dab of glue should be put in the V-notch of each rib and the leading edge dropped in place. This portion of the wing assembly should be allowed to dry very thoroughly, preferably overnight, before disturbing the set-up. The sheet tips are now glued in place along the centerline of each rib and the 1/16 in. sheet gussets should be located on top and bottom of each tip as shown on the drawings and 1/8 in. outside diameter tubing glued in place at the same time in the left tip.

Select a piece of 1/4 square hardwood, motor mount stock. Cut it to fit snugly between the center ribs and drill to receive the bellcrank mounting screw. Check the wing drawing and fuselage side view for the exact location of the bellcrank and glue the hardwood block in place. Fasten the .016 dia. flexible steel lead-outs to the bellcrank and then bend the push rod to shape, as shown in the full size detail at the right side of the plans, and fasten the bellcrank permanently in place with the lead-outs and push rod attached. The center panel of the wing should now be covered with 1/16 in. thick medium hard sheet balsa top and bottom.

Very carefully sand the entire wing structure, using a sanding block, using progressively finer grit with No. 8-0 sandpaper used last. Take considerable time and care with this step, removing all lumps and bumps and excess glue. Sanding the structure carefully not only makes for an easier and better looking covering job, but also reduces the final weight, without sacrificing strength: the mark of the expert modeler.

Add 1/2 oz. of weight, either clay or solder, to the underside of the right tip and glue it securely in place. Give the wing structure one or two coats of thinned dope, sanding after each coat and then cover with

silkspan. By eliminating colored dope on the wing, a great deal of needless weight is saved without sacrificing appearance.

At this point the wing should be carefully checked for warps. If any warps are present they may be removed by proper application of dope. Brush thinned clear dope on the side opposite the direction of warp, allowing each coat to dry thoroughly before coating the warped side. Twisting the wing to remove the warps while the dope is setting up will also help remove some of the really stubborn twists. Continue this process until six coats of clear dope thinned 50-50 are applied. To insure a warp-free wing for the life of the model, the last three or four coats should be plasticized with castor oil (approximately 20 drops to 4 oz. of dope), making the covering tough and resilient. So much for the wing. Let's get on with the rest of the job.

Since the fuselage is the easiest and most enjoyable portion to build (for us, anyhow), we'll slide through in a hurry. The fuselage sides should be traced on 1/8 in. thick medium hard sheet balsa directly from the side view of the plans and cut precisely to size. Mark the position of the bulkheads on each side, making certain you have one right side and one left.

Cut out two plywood doublers from 1/16 in. thick aircraft plywood, tracing them from the shaded outlines on the drawings and cement one doubler to the inside of each side piece. Place all the heavy objects you can find in the basement on these assemblies while the cement is drying to insure a good bond between the plywood and balsa. Trace and cut out one of each of the formers shown on the drawing, using the materials noted on the plans.

Cut motor mounts to length from 1/4 x 3/8 in. hardwood, shaping them as shown in the top view of the fuselage. Cement the mounts to the inside of each half of the fuselage. Cement the mounts to the inside of each half of the fuselage, using a good grade of fuelproof cement. Before the cement dries, check the alinement of the mounts for zero degrees vertical thrust and location from the top of the fuselage sides.

Begin the fuselage assembly by cementing forms F-1 and F-4 in place to one side and then cementing the other side in place. Pull the sides together at the rear and add F-3 and F-5 in their respective places. Bend the landing gear to shape over the fullsize projected outlines, and then sweep forward as shown on the fuselage side view. Sew the gear to F-2 with soft copper wire, coat liberally with cement and then insert F-2 in the fuselage at the front of the wing cut out. Add the 1/8 in. diagonal balsa gussets as shown.

The wing assembly should now be placed and centered, after slipping the pushrod through the openings in F-4 and the slot in the right side of the fuselage. Cement the wing securely in position and replace the small cut-out segments of the fuselage side underneath the wing. The bottom portion of the fuselage may now be covered with 1/16 in. thick medium hard sheet balsa.

Before going any further with the fuselage, make the tail feathers. The rudder and dorsal fin are cut from 1/8 in. thick soft balsa sheet and lightly sanded to an approximately airfoil shape. The stab and elevators are cut from 3/32 in. medium hard sheet and, like the rudder, lightly sanded to shape.

The control horn should be cut out of 1/32 in. thick aluminum or tin can stock as shown in detail and bent to shape. Place the horn in the position shown on the elevators, cementing and sewing it in place with cotton thread.

Before covering the top of the fuselage with 1/16 in. sheet, the stab and elevator assembly should be securely cemented in place. Cut the canopy from 1/2 in. thick

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1. J. Foster, USA, 15:00	1. D. Kneeland, USA, 15:00
1. H. O'Donnell, GB, 15:00	2. G. Fuller, GB, 13:18
1. E. Scotto, Argentina, 15:00	3. G. Vidossich, Italy, 12:54
2. G. Reich, USA, 14:59	4. P. Buskell, GB, 12:30
3. Mme. L. Ferber, Belgium, 14:55	5. A. Lederer, Austria, 12:27

(Under section 16 of the Wakefield rules, the jury decided that the Wakefield Cup had been won by three nations, because of a three way tie, but should be held by the U. S. since Joe Foster topped the fly-off. America was the team winner in both FAI and Wakefield, with British second in each.)

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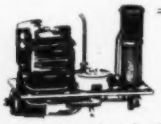
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balsa scrap and sand to a teardrop shape. Cement the rudder, dorsal fin and canopy to the top of the fuselage, checking the alinement very carefully.

Although a metal wedge or square tank may be used successfully, we strongly recommend a balloon tank for this model to insure proper fuel flow at all times. If a balloon tank is decided upon, build a compartment for it by cementing a piece of 1/16 in. sheet balsa on top of the mounts and adding a piece of sheet between the mounts and the top as shown to form a box. Bend a tailskid to the shape shown from 1/16 in. wire and fasten to the underside of the fuselage with a piece of muslin and plenty of cement.

Complete the construction by sanding the complete fuselage and tail structure in a manner similar to that used on the wings. For additional strength and a good finish with no extra weight, dope 1 in. wide strips of silkspan on all sides of the fuselage.

The upper portion of the tank compartment is hinged at the firewall with a piece of elevator hinge material to provide access to the balloon. This cover may be held down best with a lightweight rubber band stretched over the top and looped over two hooks bent from 1/32 in. music wire and cemented on each side of the fuselage.

Finish the constrution with approximately five coats of thinned color dope on the fuselage and tail surfaces and in the engine and tank compartments. Use a good fuelproof dope such as Aero-Gloss or Sta in the colors of your choice. The original Spooky had yellow wings and tailfeathers and a red fuselage. The canopy frames were striped in white and the remainder of the canopy was black. Decals and license numbers make for a more finished appearance and don't cost very much, so use them liberally for effect.

Ready to fly, the model should balance on the leading edge of the wing or within 1/2 in. of that point. If it doesn't, add weight to the nose or tail as required and don't attempt a flight until it does balance properly. If you have built and flown a "Ukie" job before, it would be ridiculous for us to tell you how to do it. If, however, this is your first project, we strongly urge you to find an experienced pilot and let him check both you and the ship out.

Spooky, properly constructed, is steady and forgiving but designed primarily for stunt work. So, give it and yourself a break. All that work merits a greater reward than a pile of assorted scrap smothered in tears.

BILL OF MATERIAL

(All measurements in inches)

3 pieces 1/8 x 3 x 36 medium hard sheet balsa; 2 pieces 1/16 x 3 x 36 medium hard sheet balsa; 1 piece 3/32 x 2 x 36 medium hard sheet balsa; 1 piece 1/16 x 6 x 12 aircraft plywood; 1 piece 1/4 x 3/8 x 12 hardwood motor mount stock; 1 piece 1/16 dia. steel music wire 3 ft. long; 1 piece 3/64 dia. steel music wire 3 ft. long; 1 pkg. .016 dia. flexible lead-out wire; 1 2-in. bellcrank; 1 pair 1-1/4 dia. wheels; 8 oz. clear dope; 8 oz. thinner; 4 oz. colored dope; 1 tube cement.

Keep That Gassie Spin-Proof

(*Continued from page* 21)

of the leading edge of the wing.

The point of balance is especially important in spiral stability under power as it serves as the pivot point of a "see-saw" with the pylon area sitting on one end of the plank and the rudder area on the other end. The farther the balance is back of the front of the pylon, the more drastic is the effective force of the prop wash on the pylon. With a large area pylon, such as in a hatchet fuselage, the ship may spin.

Standard proportional formulas are reliable and are recommended for the Spin-Resistant Design. Elevator 33 to 38 per cent of the wing area. Fuselage moment arm one half the wing span. Balance at center (or slightly back of center) of wing. If you have a ship with elevator area larger than the above which is power spin crazy, cut the elevator to the standard size, move the weight forward as indicated, and see that there is adequate sub-rudder area. Then watch the results.

Late experiments seem to prove the value of having a fair proportion of the side area of the rudder under the line of thrust, possibly a third to a half of the area that is above the line of thrust. Walter Good designed the famous stable Rudder Bug that way, and the ship seems never to show spin tendencies under power with neutral rudder tab. Our English friends are strong for center sub-rudders and call them anti-spin fins. The boys with hatchets like the Zombi, Powerhouse, and Pacer get a sub-rudder effect with drastic down thrust, for this pulls the line of thrust well up on the rudder area. If your ship has violent spinning tendencies to the right under power, try putting more center sub-rudder on temporarily at the test field by cementing on a slab of soft 1/8 in. sheet.

Percentage formulas will be found of little value in fixing the area of the rudder as many factors influence its size, such as dihedral, moment arm, pylon area and center of balance. On a new job it may be well to start with a fair portion of the rudder made of sheet so it can be whittled down if necessary. Carl Goldberg is correct in urging the smallest rudder that will work well on the ship. There is a simple rule to tell how the rudder is acting on the pylon ship: *under power, small rudder, right; large rudder, left.* If the ship is doing well to the left on the glide but tends to spin right under power, enlarge the rudder area, and do not leave out the sub-rudder. If the pylon area is not too large, this should correct the power spin characteristics.

Using twin rudders only on the tips of the elevator is impractical for pylon ships, as twins offer no opportunity for the prop wash to correct the strong right turn action of the wash on the pylon. Sub-rudders near the elevator tips are likewise negligible under power. A hatchet job with only twin rudders presents an almost impossible problem in drastic right circle under power. The same happens with use of dihedraled elevator to eliminate rudder. A large center rudder with adequate center sub-rudder seems the only correction in these cases.

Many of the problems of spiral stability and correct rudder size are eliminated when the ship is designed with aluminum pylon area. There is a temptation to cowl in the motor completely, but this greatly enlarges the side area at the front that is exposed to the prop blast. It may be seriously doubted that streamlined advantages of a completely cowled-in motor can be measured in flight on a stop watch. On the other hand, the enlarged side area of the pylon, because of the full cowling, may present most serious right spin tendencies, and require a large cumbersome center rudder and large sub-rudder. With large pylon side area, adjustments tend to be critical at best and difficult for all except the most expert builder. A hatchet job adjusted to one diameter and pitch propeller may easily spin to its destruction if a different size or make propeller is used or if the motor suddenly picks up an additional thousand rpm's. A ship with small pylon side area, with as small a center top rudder as practical and a proportional sub-rudder, tends to perform the same with different motor speeds and with various size propellers, proving that such a design is power spin resistant.

Editor's note: Another article on design will appear in November issue. Paul Gilliam writes "Seven Years with the Civy Boy." Don't miss it.

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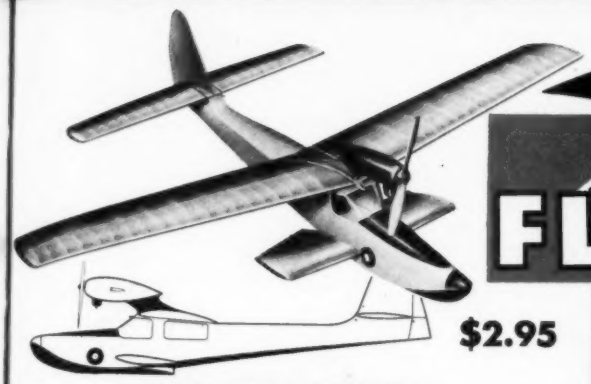

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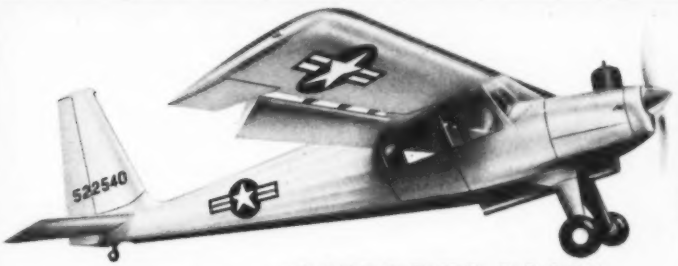

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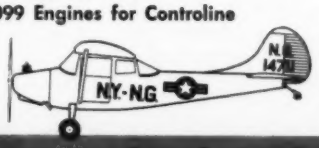

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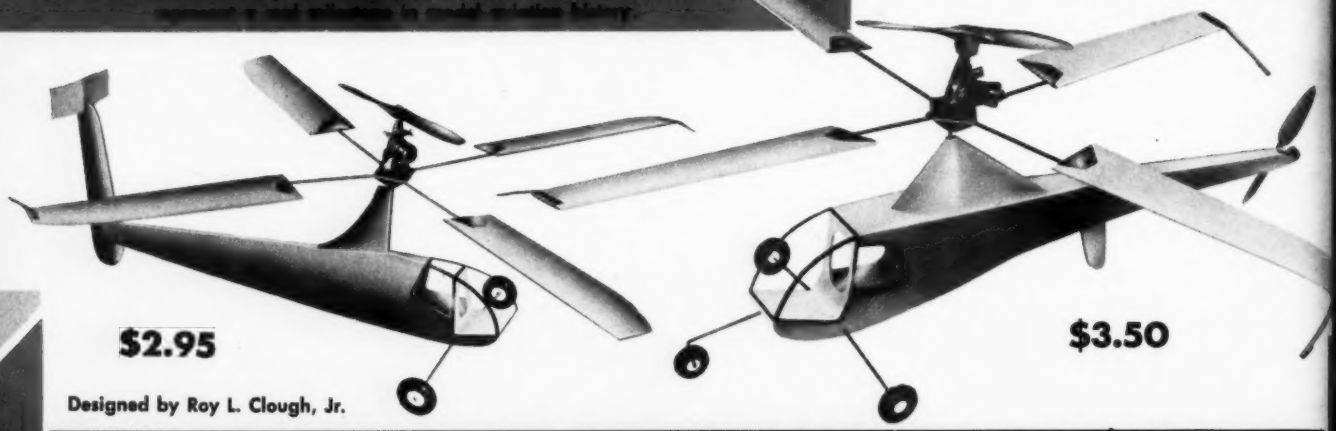

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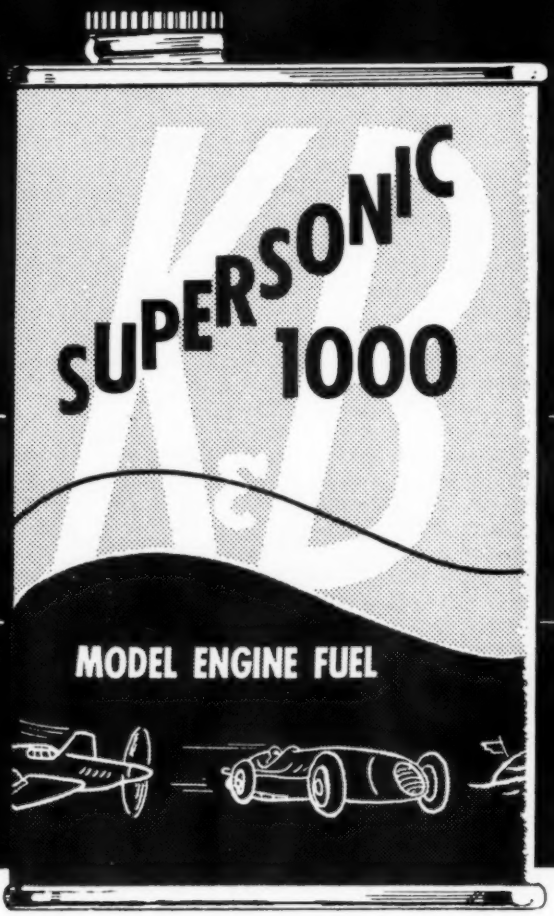

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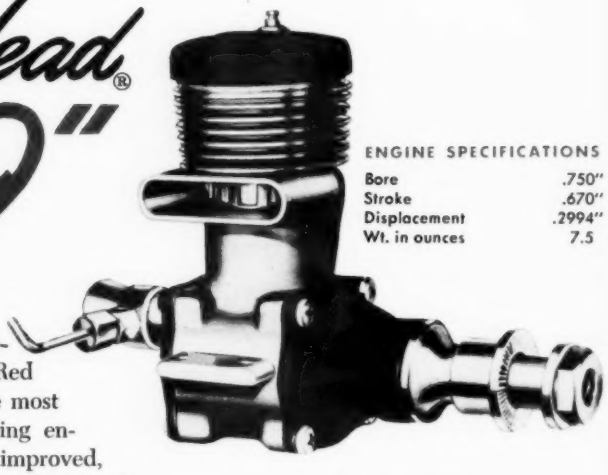

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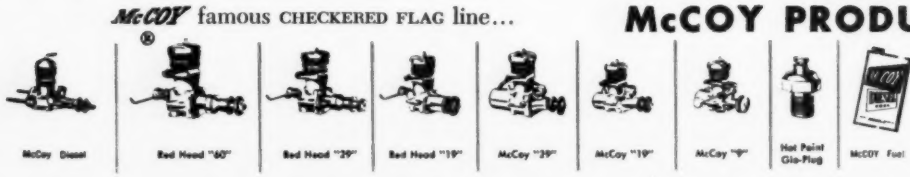

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